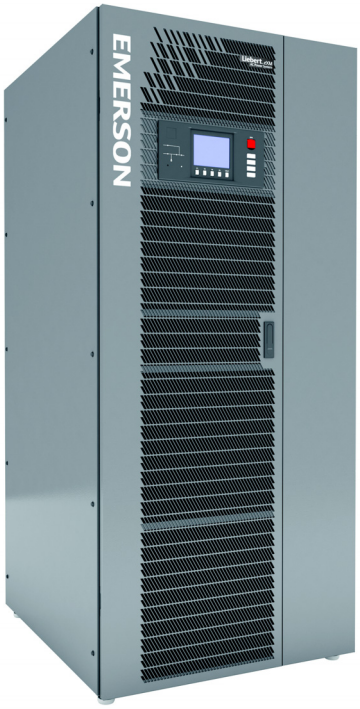
Liebert® eXM™

User Manual—120-200kVA, 50/60Hz



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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during installation of the Liebert *e*XM.

Read this manual thoroughly, paying special attention to the sections that apply to your installation, before working with the UPS. **Retain this manual for use by installing personnel.**

A properly trained and qualified electrical contractor should oversee the installation of the equipment.

The Liebert *e*XM cannot be put into operation until it is commissioned by the manufacturer or authorized engineer. Otherwise, human safety may be endangered and damage to the UPS will not be covered by the warranty.

The Liebert *e*XM is designed for commercial and industrial uses and cannot be used as life support equipment.

WARNING

Risk of moving heavy equipment and electric shock. Can cause equipment damage, injury and death.

Exercise extreme care when handling UPS cabinets to avoid equipment damage or injury to personnel. The Liebert *e*XM's weight ranges from 1221 to 1516 lb. (533 to 688kg).

Locate the center of gravity symbols before handling the UPS. Test lift and balance the cabinet before transporting it. Never tilt the equipment more than 15 degrees from vertical.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers or those approved for use in fighting electrical fires.

Extreme caution is required when performing maintenance.

Be constantly aware that the UPS system contains high DC as well as AC voltages.

Check for voltage with both AC and DC voltmeters prior to making contact.

AVERTISSEMENT

Risque lors du déplacement de l'équipement lourd et de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

Faites preuve d'une extrême prudence lors de la manutention des armoires ASC afin d'éviter de les endommager ou de blesser le personnel. L'armoire Liebert eXM pèse de 1221 à 1516 lb (de 533 à 688 kg).

Repérez les symboles de centre de gravité avant déplacer l'armoire ASC. Faites des essais de levage et d'équilibre avant de transporter l'armoire. N'inclinez jamais l'équipement à plus de 15 degrés à la verticale.

En cas d'incendie associé à du matériel électrique, n'utilisez que des extincteurs à dioxyde de carbone ou homologués pour la lutte contre les incendies d'origine électrique.

Les opérations d'entretien requièrent une extrême prudence.

Soyez toujours conscient du fait que le système ASC contient des tensions c.c. et c.a. élevées.

Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact.

WARNING

Risk of electric shock. Can cause equipment damage, injury and death.

As with other types of high power equipment, dangerous voltages are present within the UPS and battery enclosure even after input power has been disconnected. The risk of contact with these voltages is minimized as the live component parts are housed behind a metal panel. Further internal safety screens make the equipment protected to IP20 standards. Never remove panels or covers or open doors that will expose internal components to contact.

Read and follow all warnings, cautions and safety and operating instructions to avoid serious injury or death from electric shock. No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures.

All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel.

AVERTISSEMENT

Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

À l'instar des autres types d'équipement haute puissance, des tensions dangereuses sont présentes à l'intérieur de l'armoire ASC et du châssis de batteries même après le débranchement de l'alimentation d'entrée. Le risque de contact avec ces tensions est diminué, car les parties de composants sous tension sont abritées derrière un panneau métallique. D'autres écrans de sécurité internes protègent l'équipement en conformité avec les normes IP20. Ne retirez jamais les panneaux ou les couvercles et n'ouvrez pas les portes donnant accès aux composants internes avec lesquels vous pouvez entrer en contact.

Veuillez lire et suivre l'ensemble des avertissements, des mises en garde et des instructions de sécurité et de fonctionnement afin d'éviter des blessures graves, voire la mort, pouvant être causées par une décharge électrique. Il n'y a aucun risque pour le personnel lorsque l'équipement est utilisé normalement, en suivant les procédures de fonctionnement recommandées.

Toutes les procédures de réparation et d'entretien de l'équipement exigent un accès à l'intérieur de l'armoire et devraient être menées uniquement par du personnel compétent.

Ground Leakage Currents

CAUTION

Risk of electric shock from high leakage current. Can cause injury, property damage and death.

EARTH CONNECTION IS ESSENTIAL BEFORE CONNECTING THE INPUT SUPPLY.

Earth leakage current exceeds 3.5 mA and is less than 1000 mA.

Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous RCCB or RCD devices.

Residual Current Circuit Breakers (RCCBs) must be selected sensitive to DC unidirectional pulses (Class A) and insensitive to transient current pulses.

Note also that the earth leakage currents of the load will be carried by this RCCB or RCD.

This equipment must be earthed in accordance with the local electrical code of practice.

AVERTISSEMENT

Risque de décharge électrique due à un courant de fuite élevé pouvant causer des blessures, des dommages matériels et même la mort.

IL EST PRIMORDIAL D'ASSURER UNE CONNEXION DE TERRE AVANT DE BRANCHER L'ALIMENTATION D'ENTRÉE.

La fuite à la terre est supérieure à 3,5 mA et inférieure à 1 000 mA.

Vous devez tenir compte des fuites de courant transitoires et permanentes à la terre, susceptibles de se produire au démarrage de l'équipement, lors de la sélection des dispositifs DDFT instantanés.

Vous devez sélectionner des disjoncteurs différentiels de fuite à la terre (DDFT) sensibles aux impulsions unidirectionnelles c.c. (classe A) et insensibles aux impulsions de courant transitoires.

Notez également que les courants de fuite à la terre de la charge seront acheminés par ce dispositif DDFT.

Cet équipement doit être mis à la terre conformément au code national de l'électricité.

WARNING

Risk of electric shock. Can cause injury, property damage and death.

Under typical operation and with all UPS doors closed, only normal safety precautions are necessary. The area around the UPS system should be kept free of puddles of water, excess moisture and debris.

Special safety precautions are required for procedures involving handling, installation and maintenance of the UPS system. Observe all safety precautions in this manual before handling or installing the UPS system as well as during all maintenance procedures.

This equipment contains several circuits that are energized with high voltage. Only test equipment designed for troubleshooting should be used. This is particularly true for oscilloscopes. Always check with AC and DC voltmeters to ensure safety before making contact or using tools. Even when the power is turned Off, dangerously high electric charges may exist within the UPS.

All power and control wiring should be installed by a qualified electrician. All power and control wiring must comply with the NEC and applicable local codes.

ONLY qualified service personnel should perform maintenance on the UPS system. When performing maintenance with any part of the equipment under power, service personnel and test equipment should be standing on rubber mats. The service personnel should wear insulating shoes for isolation from direct contact with the floor (earth ground).

Never work alone, even if all power is removed from the equipment. A second person should be standing by to assist and summon help in case an accident should occur.

AVERTISSEMENT

Risque de décharge électrique pouvant causer des blessures, des dommages matériels et même la mort.

Les précautions de sécurité habituelles suffisent lorsque le système ASC est en mode de fonctionnement normal et que toutes les portes sont fermées. La zone entourant le système ASC doit être exempte de flaques d'eau, d'humidité excessive et de débris.

Des précautions de sécurité spéciales sont requises pour les procédures associées à la manutention, à l'installation et à l'entretien du système ASC. Observez toutes les précautions de sécurité décrites dans le présent manuel avant de manipuler ou d'installer le système ASC, ainsi que pendant toutes les procédures d'entretien.

Cet équipement comporte plusieurs circuits à haute tension. Seuls des équipements d'essai conçus pour le dépannage doivent être utilisés. Cette mise en garde couvre notamment les oscilloscopes. Utilisez toujours des voltmètres c.a. et c.c. pour vérifier les tensions avant d'établir un contact ou d'utiliser des outils. Des tensions dangereusement élevées peuvent demeurer dans le système ASC même une fois l'alimentation coupée.

Tous les câbles d'alimentation et de contrôle doivent être installés par un électricien qualifié. Tous les câbles d'alimentation et de contrôle doivent être conformes au Code national de l'électricité des États-Unis (NEC) et celui du Canada, ainsi qu'aux codes locaux en vigueur.

L'entretien du système ASC ne doit être confié qu'à des professionnels qualifiés.

Les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc lors de toute intervention sur une pièce d'équipement sous tension. Les responsables de l'entretien doivent porter des chaussures isolantes pour prévenir tout contact direct avec le plancher.

Ne travaillez jamais seul, même si toute l'alimentation d'entrée est coupée de l'équipement. Une seconde personne devrait toujours être présente pour porter assistance ou chercher de l'aide en cas d'accident.

WARNING

Failure to follow adequate grounding procedures can result in electric shock hazard to personnel, or the risk of fire, should a ground fault occur.

All operations described in this section must be performed by properly trained and qualified electricians or technical personnel. If any difficulties are encountered, contact Emerson Network Power. See the back page of this manual for contact information.

AVERTISSEMENT

Le non-respect des procédures de mise à la terre peut entraîner des risques d'électrocution du personnel, ou des risques d'incendie en cas de défectuosité de la mise à la terre.

Toutes les opérations décrites dans cette section ne doivent être effectuées que par des électriciens ou des techniciens professionnels dûment formés et qualifiés . En cas de difficultés, communiquez avec Emerson Network Power. Pour obtenir les renseignements de contact, consultez la dernière page de ce manuel.

NOTICE

Risk of improper ground connection. Can cause equipment damage.

Ground connection is essential before connecting the input supply. This equipment must be grounded in accordance with local electrical codes. Maximum load must not exceed that shown on the UPS rating label.

NOTICE

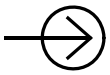
Risk of improper electromagnetic shielding. Can cause radio communication interference.

This unit complies with the limits for a Class A digital device, pursuant to Part 15 Subpart J of the FCC rules. These limits provide reasonable protection against harmful interference in a commercial environment. This unit generates, uses and radiates radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. This unit is not designed for use in a residential area. Operation of this unit in a residential area may cause harmful interference that the user is solely responsible for correcting.

GLOSSARY OF SYMBOLS

Risk of electrical shock

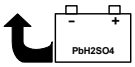
Indicates caution followed by important instructions



AC input

AC output

Requests the user to consult the manual



Indicates the unit contains a valve-regulated lead acid battery

Recycle

DC voltage

AC voltage

Equipment grounding conductor

Bonded to ground

1.0 INTRODUCTION

The Liebert *e*XM UPS is a fixed-capacity, transformer-free, online uninterruptible power system with 208/120V input and 208/120V output capability. The Liebert *e*XM can operate with either a 50 or 60Hz input and provide a matching output frequency conversion.

Optional Maintenance Bypass and Parallel cabinets are available.

The Liebert *e*XM provides continuous, high-quality AC power to business-critical equipment, such as telecommunications and data processing equipment. The Liebert *e*XM supplies power free of the disturbances and variations in voltage and frequency common to utility power, which is subject to brownouts, blackouts, surges and sags.

The Liebert *e*XM utilizes the latest in high-frequency, double-conversion pulse width modulation (PWM) technology and fully digital controls to enhance its reliability and increase the ease of use.

The 120-200kVA/kW Liebert *e*XM requires external batteries to support the load when utility power is not present. For ancillary cabinets, refer to **2.6 - Auxiliary Cabinets**.

2.0 INSTALLATION

This section describes the Liebert *e*XM's environmental requirements and mechanical considerations that must be taken into account when planning the positioning and cabling of the UPS equipment.

Because each site is unique, this section presents a guide to general procedures and practices that should be observed by the installing engineer, rather than step-by-step installation instructions.

NOTICE

Risk of improper installation. Can cause equipment damage.

Do not apply electrical power to the UPS equipment before the commissioning engineer arrives at the installation site.

The UPS must be installed by a properly trained and qualified engineer in accordance with the information contained in this chapter. All the equipment not referred to in this manual is shipped with details of its own mechanical and electrical installation information.

NOTE

Three-phase, four-wire input power is required.

NOTE

*Input power must be supplied to the Liebert e*XM *from a properly grounded Wye or Delta source. The Liebert e*XM *is not for use with impedance grounded systems, corner-grounded systems or high-leg Delta systems. For these applications, an isolation transformer must be installed between the input power and the Liebert e*XM.

2.1 Initial Inspections

1. While the Liebert *e*XM and ancillary cabinets are still on the truck, inspect the equipment and shipping container for any signs of damage or mishandling. Do not attempt to install the system if damage is apparent. If any damage is noted, file a damage claim with the shipping agency immediately and contact Liebert Services at 1-800-LIEBERT to inform them of the damage claim and the condition of the equipment.
2. Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier and your local Emerson representative immediately.
3. Check the product label on the back of front door and confirm the contents match the UPS model, capacity and main parameters that were ordered.

2.1.1 Storing for Delayed Installation

If the equipment will not be installed immediately, it must be stored indoors where the humidity is no higher than 90% and the temperature is no higher than 104°F (40°C). The storage area must protect the Liebert *e*XM from excessive moisture (see **8.2 - UPS Environmental**).

2.2 Preliminary Checks

2.2.1 Identification

The equipment supplied has an identification tag on the back of the main door listing the type and size of the UPS.

2.3 UPS Location

2.3.1 Positioning the UPS

Choose a location for the UPS that offers:

- Easy connection to inputs, outputs and auxiliary equipment
- Enough space to service the UPS
- Air circulation sufficient to expel heat produced by UPS
- Protection against moisture and excessive humidity
- Protection against dust and other particulate matter
- Compliance with fire prevention regulations and practices
- Operating environment temperature of 74-80°F (23-27°C) for maximum battery life

2.3.2 Environmental Considerations

Before installing the Liebert *e*XM, verify that the UPS room satisfies the environmental conditions stipulated in **8.2 - UPS Environmental**, paying particular attention to the ambient temperature and air exchange system.

The UPS unit should be installed in a cool, dry, clean-air environment with adequate ventilation to keep the ambient temperature within the specified operating range 32°F to 104°F (0°C to 40°C).

For optimal UPS system performance and service life, maintain the operating temperature within the range of 74-80°F, (23-27°C).

The Liebert *e*XM is cooled by internal fans. Cooling air enters the unit through the front of the unit and is exhausted out the top. To permit proper air flow and prevent overheating, do NOT block or cover the ventilation openings or blow air down onto the unit. The UPS requires 24 in. (610mm) ventilation clearance above the unit.

See **Table 34** for details on heat dissipation.

2.4 Considerations in Moving the Liebert *e*XM

Ensure that the UPS weight is within the designated surface weight loading (lb./ft^2 or kg/cm^2) of any handling equipment. See **Table 1** for the weights of various units.

The Liebert *e*XM may be rolled on its casters for short distances only. For longer distances, move the UPS with a forklift or similar equipment to ease the relocation and to reduce vibration.

WARNING

Risk of moving heavy unit. Can cause property damage, injury and death.

Ensure that any equipment that will be used to move the Liebert *e*XM has sufficient lifting capacity. The Liebert *e*XM's weight ranges from 1221 to 1516 lb. (554 to 688kg). See **Table 1** for the weights of various units.

The UPS presents a tipping hazard. Do not tilt the Liebert *e*XM more than 15 degrees from vertical.

The UPS is fitted with casters—Take care to prevent movement when unbolting the equipment from its shipping pallet. Ensure adequate personnel and lifting equipment are available when taking the Liebert *e*XM off its shipping pallet.

AVERTISSEMENT

Le poids élevé de l'appareil peut entraîner des dommages matériels, des blessures et même la mort.

Veillez à ce que les équipements utilisés pour déplacer le système eXM de Liebert possèdent une capacité nominale suffisante. Le poids du système eXM de Liebert varie entre 554 et 688 kg (1221 et 1516 lb) sans les batteries. Reportez-vous au **Tableau 1** pour connaître le poids de l'appareil avec les batteries.

Le système ASC présente un risque de renversement. N'inclinez pas le système eXM de Liebert à plus de 15 degrés de la verticale.

Comme le système ASC est équipé de roulettes, veillez à éviter les mouvements involontaires lorsque vous déboulonnez l'équipement de sa palette d'expédition. Veillez à ce qu'un personnel approprié et un dispositif de levage soient disponibles lorsque vous retirez le système eXM de Liebert de la palette d'expédition.

WARNING

Risk of heavy unit tipping over while being moved. Can cause property damage, injury and death.

The casters are strong enough for movement across even surfaces only. Casters may fail if they are subjected to shock loading, such as being dropped or rolled over holes in the floor or obstructions. Such failure may cause the unit to tip over, injuring personnel and damaging the equipment.

AVERTISSEMENT

Le centre de gravité élevé de l'appareil présente un risque de renversement lors des déplacements, peut entraîner des dommages matériels, des blessures et même la mort.

Les roulettes sont suffisamment résistantes pour le déplacement sur des surfaces planes uniquement. Les roulettes peuvent être endommagées si vous les soumettez à des impacts, notamment en cas de chute ou de passage sur des obstacles ou trous dans le plancher. Une telle défaillance peut causer le renversement de l'appareil, qui risque de blesser le personnel et d'endommager l'équipement.

Final Positioning

When the equipment has been finally positioned, ensure that the adjustable stops are set so that the UPS will remain stationary and stable (see **4.0 - Installation Drawings**).

The Liebert *e*XM and its auxiliary cabinets must be installed on a concrete or equivalent, non-resilient floor.

2.5 Mechanical Considerations

The Liebert *e*XM is constructed with a steel frame and removable panels. Top and side panels are secured to the chassis by screws. The doors may be opened for access to power connections bars, auxiliary terminals blocks and power switches.

The UPS comes with an Operator Control Panel that provides basic operational status and alarm information. The cabinet houses the power components. Cooling is provided by internal fans. The unit sits on four casters. Adjustable stops are provided to prevent the UPS from moving once it has been moved to its final position.

The Wiring Cabinet (see **Figure 1**) provides the additional space to support wiring and conduit landing for the 160-200kVA models of the Liebert *e*XM. The wiring cabinet is added to the UPS when a Liebert eXM MBC is not used. The wiring cabinet provides space for the conduit and power connections to a customer-supplied maintenance bypass cabinet.

WARNING

Risk of heavy units tipping over while being moved. Can cause property damage, injury and death.

Emerson recommends lifting the units by installing four eyebolts in the factory-fabricated holes, one at each corner of the unit, attaching cables or similar strapping to the eyebolts and lifting with a suitable mechanism.

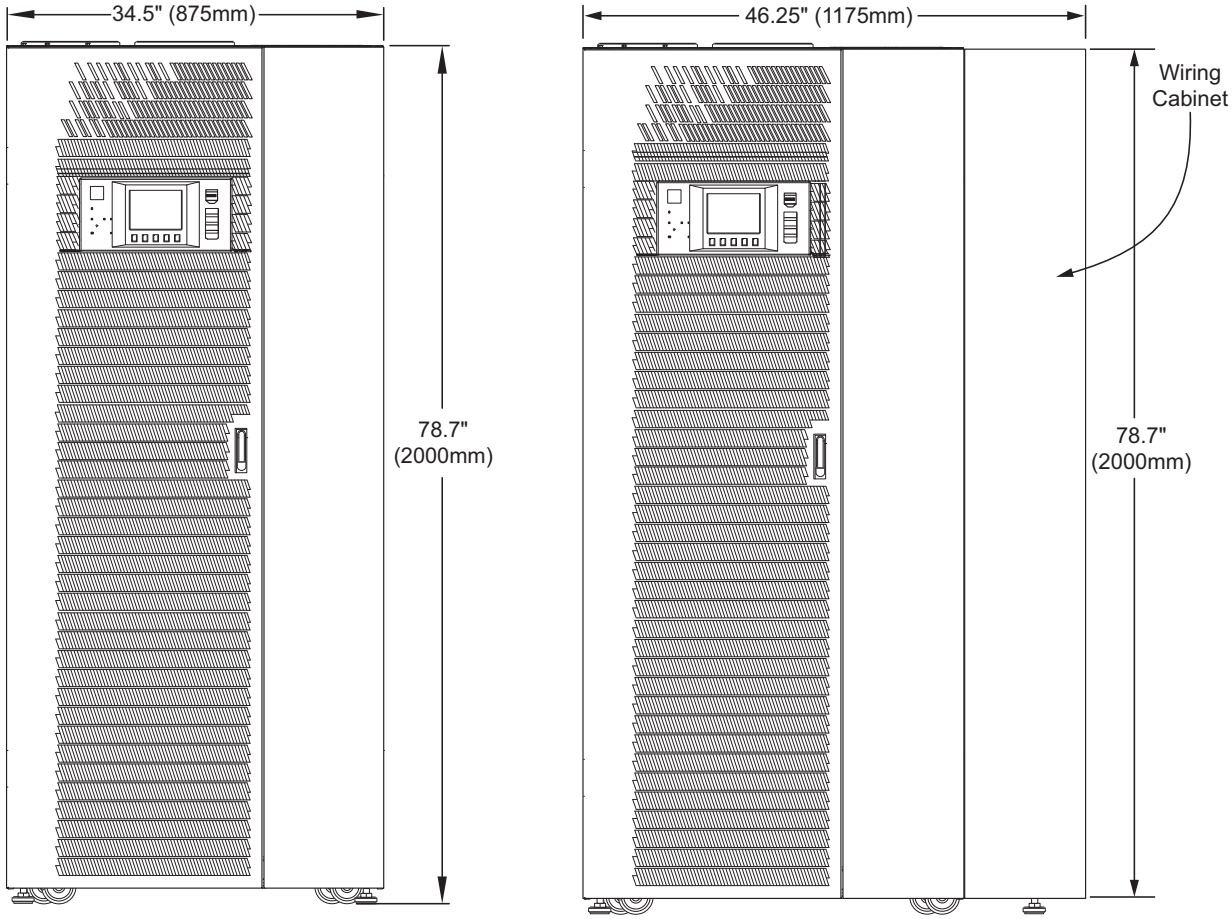
AVERTISSEMENT

Le centre de gravité élevé des appareils présente un risque de renversement lors des déplacements, peut entraîner des dommages matériels, des blessures et même la mort.

Emerson recommande de soulever les appareils en installant quatre anneaux de levage dans les ouvertures fabriquées en usine, avec un anneau dans chaque coin de l'appareil, pour ensuite fixer les câbles ou sangles aux anneaux afin d'effectuer le levage à l'aide d'un mécanisme approprié.

2.5.1 Dimensions

Figure 1 UPS dimensions



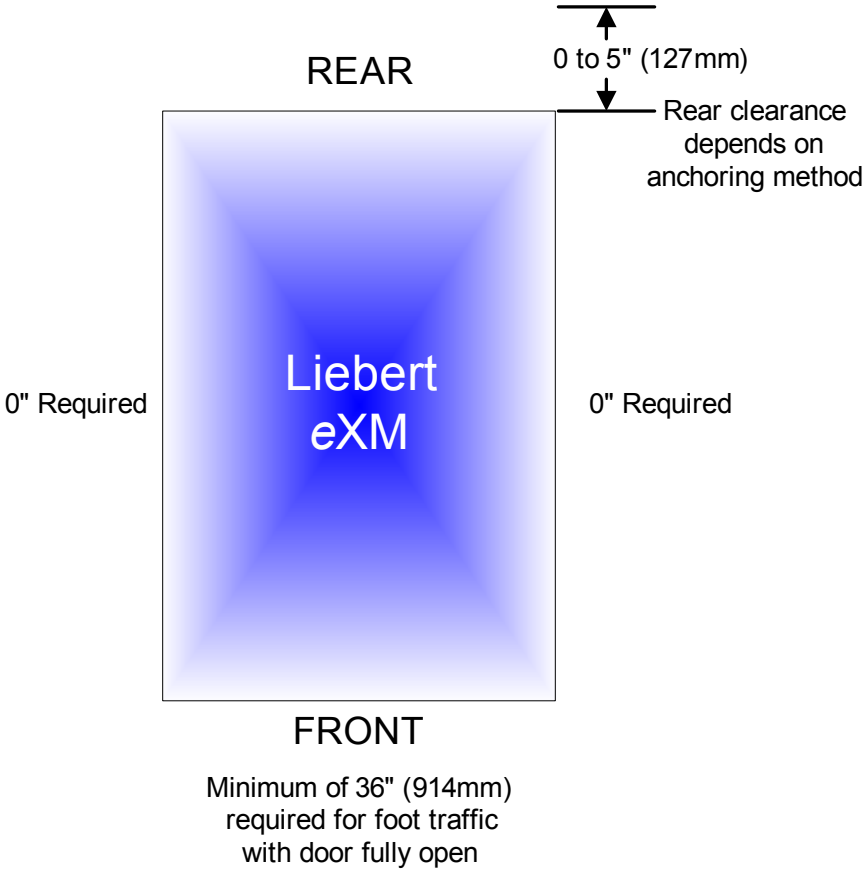
120 and 140kVA Models

160, 180 and 200kVA Models

Table 1 UPS weight

UPS Rating kVA	Unit Weight lb. (kg)	Shipping Weight lb. (kg)
120	1221 (554)	1321 (600)
140	1295 (587)	1395 (633)
160	1368 (621)	1468 (666)
180	1442 (654)	1542 (699)
200	1516 (688)	1616 (733)

2.5.2 Clearances



Provide at least the minimum clearance required by NEC on all sides of Liebert *e*XM, including 36" (914mm) in front, to permit routine tightening power terminations within the UPS and free passage of personnel with the door fully opened. Depending on the floor anchoring system used, up to 5" (127mm) may be required in the rear of the UPS.

There are no ventilation grilles on the sides or back of the UPS.

Leave a minimum of 24 in. (610mm) between the top of the UPS frame and the ceiling to permit adequate air circulation above the unit. Emerson recommends against using air conditioning or other systems that blow air onto the top of the unit.

2.5.3 Floor Installation

If the Liebert *e*XM is to be placed on a raised floor, the UPS should be mounted on a pedestal that will support the equipment point loading. Refer to the bottom view in **Figure 1** to design this pedestal.

2.5.4 Cable Entry

Cables can enter the Liebert *e*XM from the top or bottom through removable metal plates.

Some plates have factory-punched holes and others are designed to allow the personnel to punch holes for fitting and securing the conduit. Once the conduit holes are punched, these plates should be reattached to the UPS. The conduit size and wiring method must be in accordance with all local, regional and national codes and regulations, including NEC ANSI/NFPA 70.

The UPS must be accessible from the front to allow personnel to complete the cable connections and make necessary adjustments.

NOTE

When installing the UPS, the customer must provide a disconnect with overcurrent protection at the output of the UPS.

Figure 2 Cable entry locations, 120-140kVA model

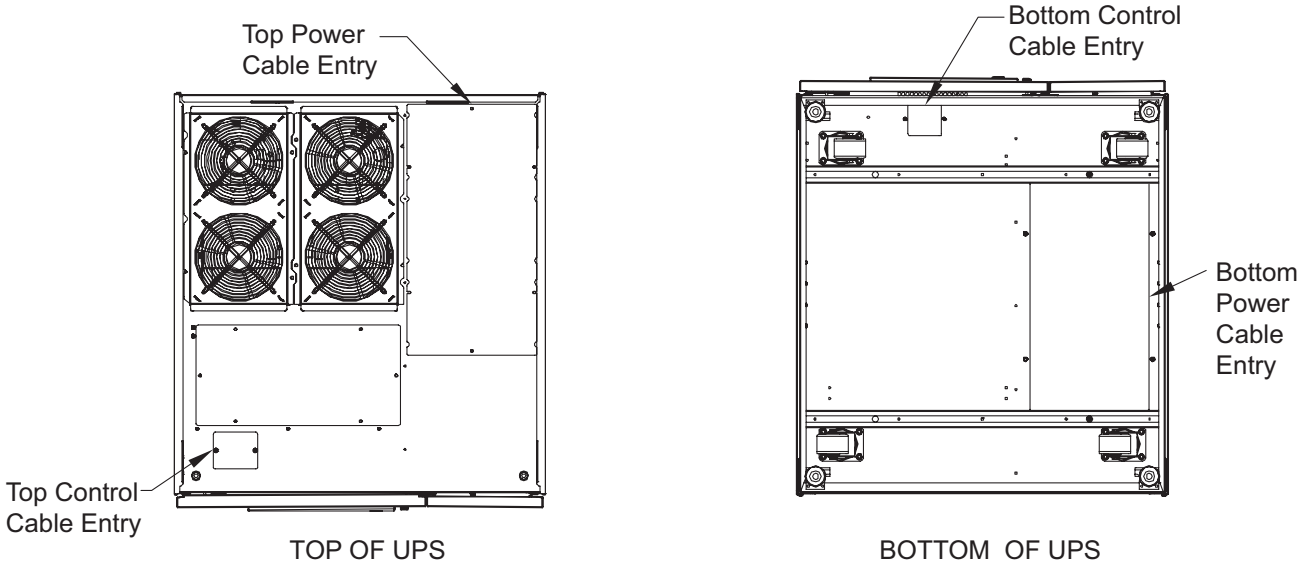
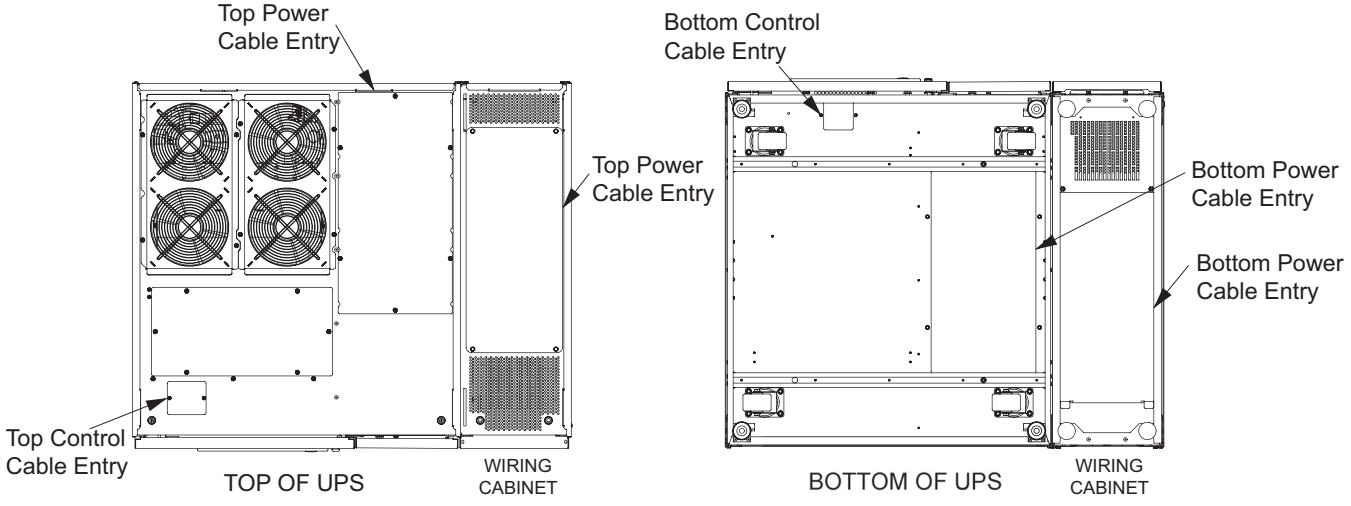


Figure 3 Cable entry locations, 160-200kVA model



2.6 Auxiliary Cabinets

The 120-200kVA frame consists of a single cabinet housing the UPS components. It does not accommodate internal batteries. The UPS requires external battery cabinets for extended run time.

Battery Cabinets—Optional battery cabinets are available for each Liebert *e*XM model to provide extended run time. The battery cabinets are designed to be bolted to the left side of the UPS (see **Figure 4**). Refer to SL-25651, the Liebert *e*XM Battery Cabinet manual, for details. Battery cabinet wiring is specified for optimal performance of the system.

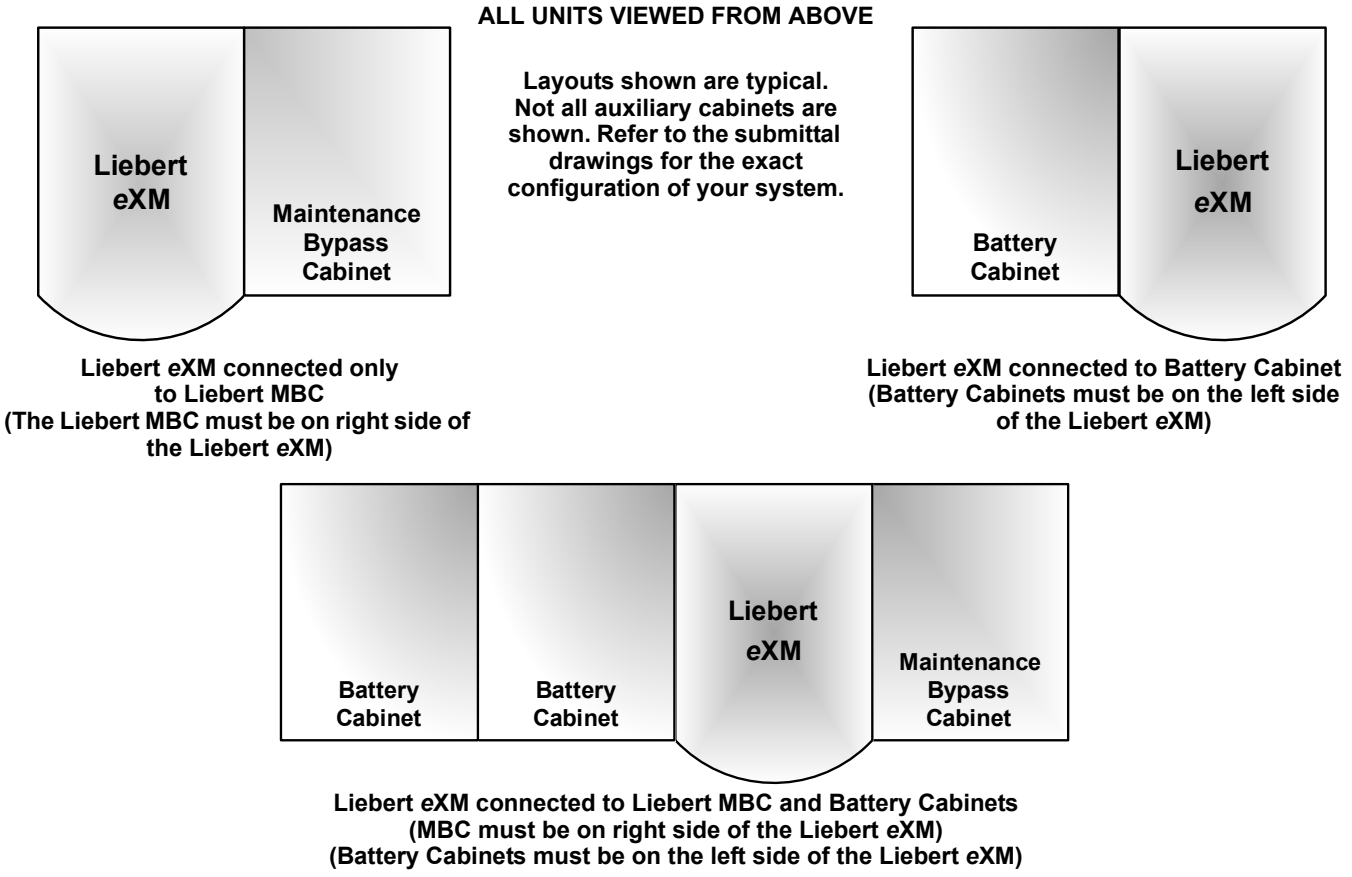
Maintenance Bypass Cabinet—Optional Liebert bypass cabinets are available. These cabinets house the components necessary to provide an external wraparound maintenance bypass switch for servicing the UPS. Liebert bypass cabinets are designed to be bolted to the right side of the UPS (see **Figure 4**). Refer to SL-25652, the Liebert *e*XM Maintenance Bypass Cabinet manual for further details.

Parallel Cabinet—The Liebert *e*XM Maintenance Bypass Cabinet provides the components for setting up two Liebert *e*XM units for parallel operation for redundant protection or to increase capacity. Refer to SL-25654, the Liebert *e*XM Parallel Cabinet for further details.

System Composition

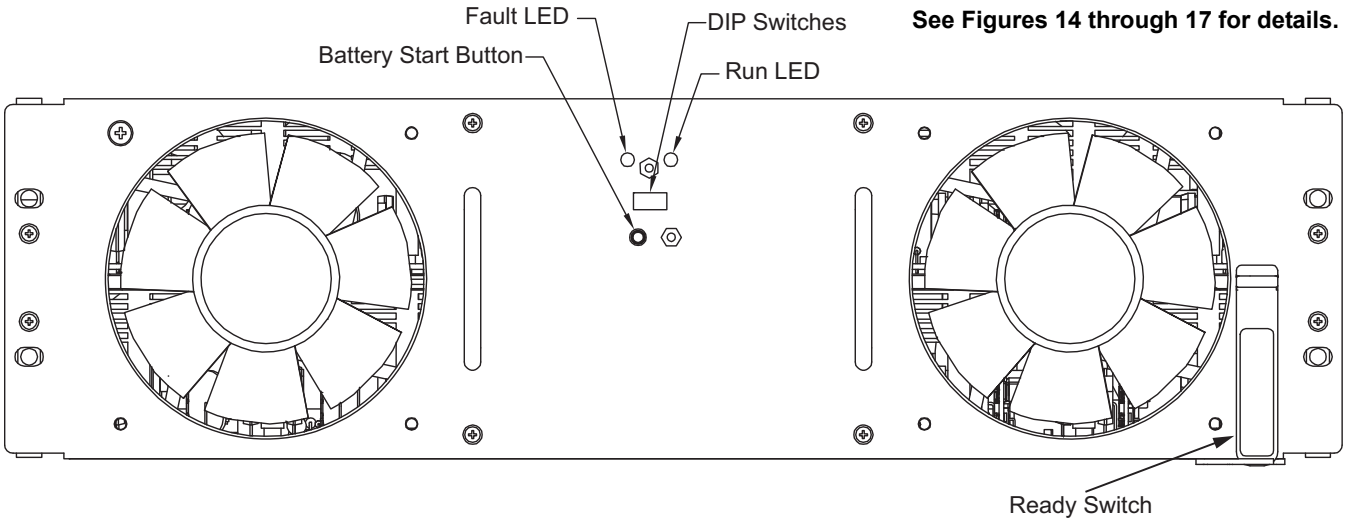
A UPS system can comprise a number of optional equipment cabinets, depending on the system design requirements—e.g., UPS cabinet, External Battery Cabinet and External Bypass Cabinet. All cabinets used will be the same height and will be designed to be positioned side-by-side to form an aesthetically appealing equipment suite.

Figure 4 Cabinet arrangement


ALL UNITS VIEWED FROM ABOVE
Layouts shown are typical. Not all auxiliary cabinets are shown. Refer to the submittal drawings for the exact configuration of your system.
Liebert eXM
Maintenance Bypass Cabinet
Liebert eXM connected only to Liebert MBC (The Liebert MBC must be on right side of the Liebert eXM)
Battery Cabinet
Liebert eXM
Liebert eXM connected to Battery Cabinet (Battery Cabinets must be on the left side of the Liebert eXM)
Battery Cabinet
Battery Cabinet
Liebert eXM
Maintenance Bypass Cabinet
Liebert eXM connected to Liebert MBC and Battery Cabinets (MBC must be on right side of the Liebert eXM) (Battery Cabinets must be on the left side of the Liebert eXM)

2.7 Liebert Power Module Assembly

Figure 5 Liebert power module assembly indicators and controls



The BATTERY START button allows starting the UPS on battery; refer to **7.3 - UPS Battery Start**.

The Run LED is illuminated Green when the Liebert power module assembly is operating normally.

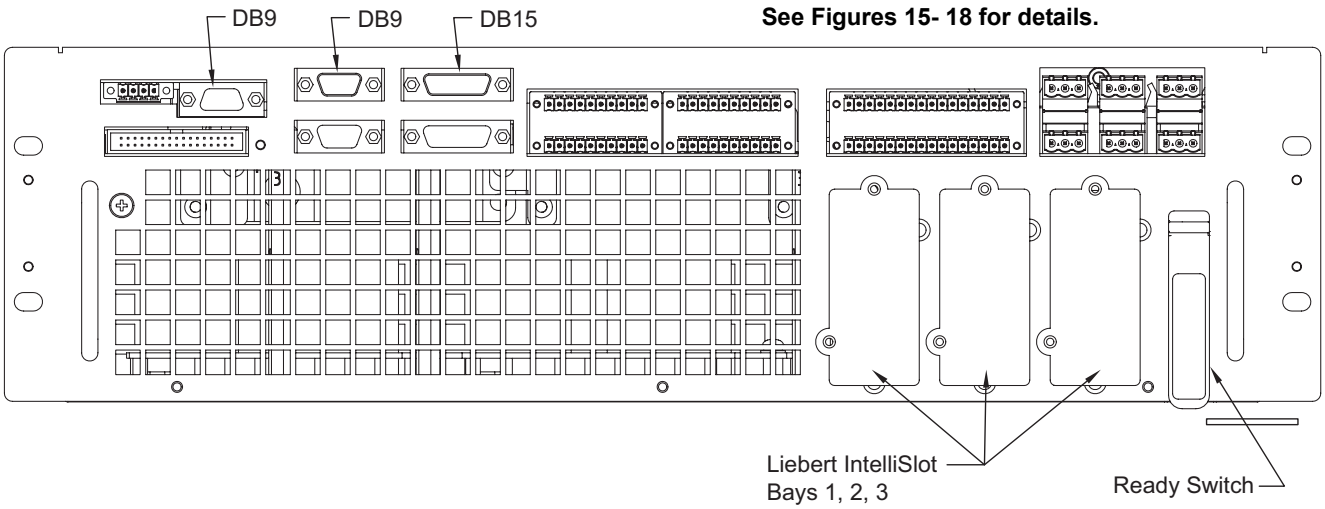
The Fault LED will illuminate red when the Liebert power module assembly has a problem.

Table 2 LED indications

LED Status	Indication
Run LED (Green)	
Flashing Green	The inverter is starting, but has no output yet.
Constant Green	The inverter has started to supply power.
OFF	The inverter has not started up.
Fault LED (Red)	
Constant Red	Auxiliary power failure (15V or 24V), rectifier overtemperature, rectifier failure (including battery SCR short circuit), battery converter failure, soft start failure, main circuit back feed, abnormal input current, inverter failure, output short circuit, bypass SCR short circuit fault, inverter relay short circuit fault, abnormal bus voltage, module not ready, module ID out of range and duplicated module ID.
Flashing Red	Charger failure, abnormal main circuit voltage, abnormal main circuit frequency, main circuit undervoltage, main circuit reverse phase, battery unavailable, reverse battery, input zero-loss, current sharing failure, module overload, inverter relay disconnection fault, bypass SCR disconnection fault and input fuse blown.
OFF	No above failures or alarms.

2.8 Control Module

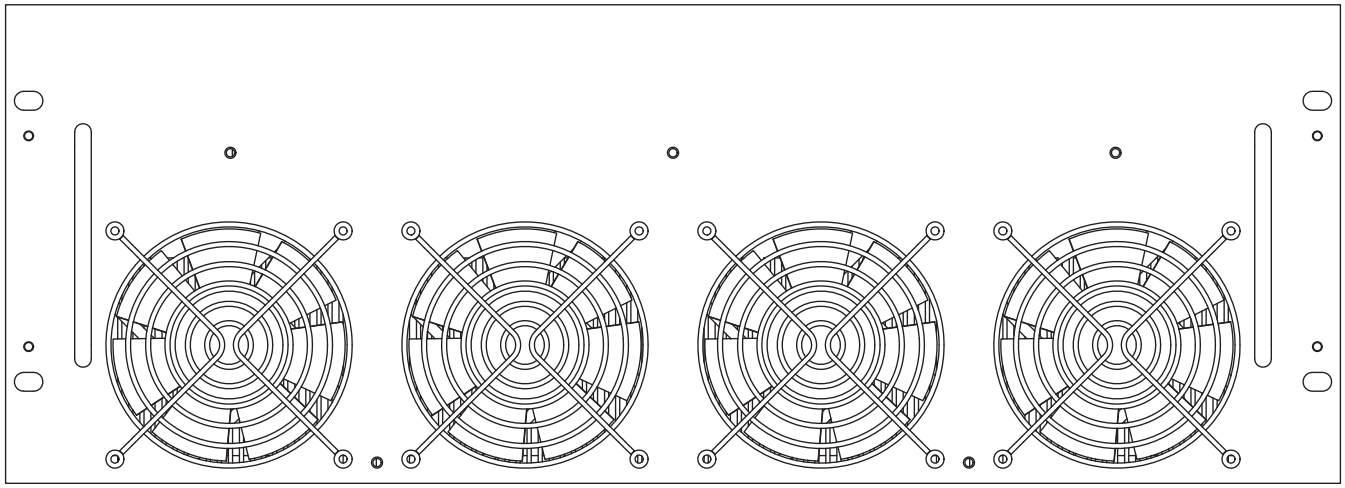
Figure 6 Control Module, front view



The Control Module has three Liebert IntelliSlot™ interface card bays and connections for optional ancillary cabinets and for other options. Refer to **Figures 14** through **17**.

2.9 Static Bypass Assembly

Figure 7 Static Bypass Assembly connections



3.0 ELECTRICAL CONNECTIONS—UPS

The UPS requires both power and control cabling once it has been mechanically installed. All control cables must run separate from power cables in metal conduits or metal ducts that are electrically bonded to the metalwork of the cabinets to which they are connected.

WARNING

Risk of electric shock. Can cause property damage, injury and death.

Before connecting input power to the Liebert *e*XM, ensure that you are aware of the location and operation of the overcurrent protection devices that connect the UPS input/bypass supply to the power distribution panel.

De-energize and lockout or tagout all incoming high- and low-voltage power circuits before installing cables or making any electrical connections.

AVERTISSEMENT

Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

Avant de procéder au branchement de l'alimentation d'entrée du système eXM de Liebert, veillez à prendre connaissance de l'emplacement et du fonctionnement des dispositifs de protection de surintensité qui raccordent l'alimentation d'entrée ou de dérivation du système ASC au panneau de distribution électrique.

Coupez l'alimentation et appliquez le verrouillage ou l'étiquetage à tous les circuits d'alimentation haute tension et basse tension avant d'installer les câbles ou d'effectuer tout autre branchement électrique.

3.1 Power Cabling

3.1.1 Lug Size and Cable Rating

The main factors affecting the choice and size of cable are voltage, current (also taking into account overcurrent), room temperature and conditions of installation of the cable. Refer to ANSI/NFPA 70.

The power cables of the system must be sized with respect to the following description:

- **UPS input cables** - The UPS input cables must be sized for the maximum input current, including the maximum battery recharge current, given in **Table 25**, with respect to the unit rating and the input AC voltage.
- **UPS bypass and output cables** - The bypass and output cables must be sized for the nominal output current, given in **Table 25**, with respect to the unit rating and the output AC voltage.
- **Battery cables** - See the Liebert *e*XM External Battery Cabinet manual, SL-25651, for battery installation guidelines and instructions. The manual ships with the battery cabinet and is available at Liebert's Web site: **www.liebert.com**

NOTE

Table 25 *gives nominal currents for determining the size of UPS power cables. Other important factors to consider include cable route length and coordination with protective devices.*

The power cables can be sized to suit the UPS unit rating according to **Table 25**.

Torque Requirements

Refer to **Tables 3** and **4** for lug size and torque requirements.

Table 3 Busbars (for power wiring)

Bolt Shaft Size	Lb-in (Nm)
1/2" (M12)	428 (48)

Table 4 Terminal block with compression lugs (for control wiring)

AWG Wire Size or Range	Lb-in (Nm)
#22 - #14	3.5 to 5.3 (0.4 to 0.6)

3.2 External Protective Devices

For safety concerns, it is necessary to install external circuit breakers or other protective devices for the input AC supply of the UPS system. This section provides generic practical information for qualified installation engineers. The installation engineers should be knowledgeable about regulatory wiring standards and the equipment to be installed.

To reduce the risk of fire, connect only to a circuit provided with branch circuit overcurrent protection in accordance with NEC ANSI/NFPA 70.

3.2.1 Rectifier and Bypass Input Supply of the UPS

Overcurrents

Install suitable protective devices in the distribution unit of the incoming mains supply, considering the power cable current-carrying capacity and overload capacity of the system. Generally, the magnetic circuit breaker with IEC60947-2 tripping curve C (normal) at the 125% of the nominal current listed in **Table 25** is recommended.

Split bypass: In case a split bypass is used, separate protective devices should be installed for the rectifier input and bypass input in the incoming mains distribution panel. A shunt trip coil of 120V must be installed in the bypass input breaker if the system does not include a Liebert Bypass Cabinet. Refer to **Figure 8** for more details.

NOTE
The rectifier input and bypass input must use the same neutral line.

Earth Leakage, RCD Devices

Any residual current detector (RCD) installed upstream of the UPS input supply:

- Must be sensitive to DC unidirectional pulses (Class A)
- Must be insensitive to transient current pulses, and
- Must have an average sensitivity, adjustable between 0.3 and 1A.

To avoid false alarms, earth leakage monitoring devices when used in systems with split bypass input or when used in paralleled UPS configurations, must be located upstream of the common neutral sinking point. Alternatively, the device must monitor the combined four-wire rectifier and split bypass input currents.

3.2.2 UPS Output

If an external distribution panel is used for load distribution, the selection of protective devices must provide discrimination with those that are used at the input to the UPS (see **Table 30**).

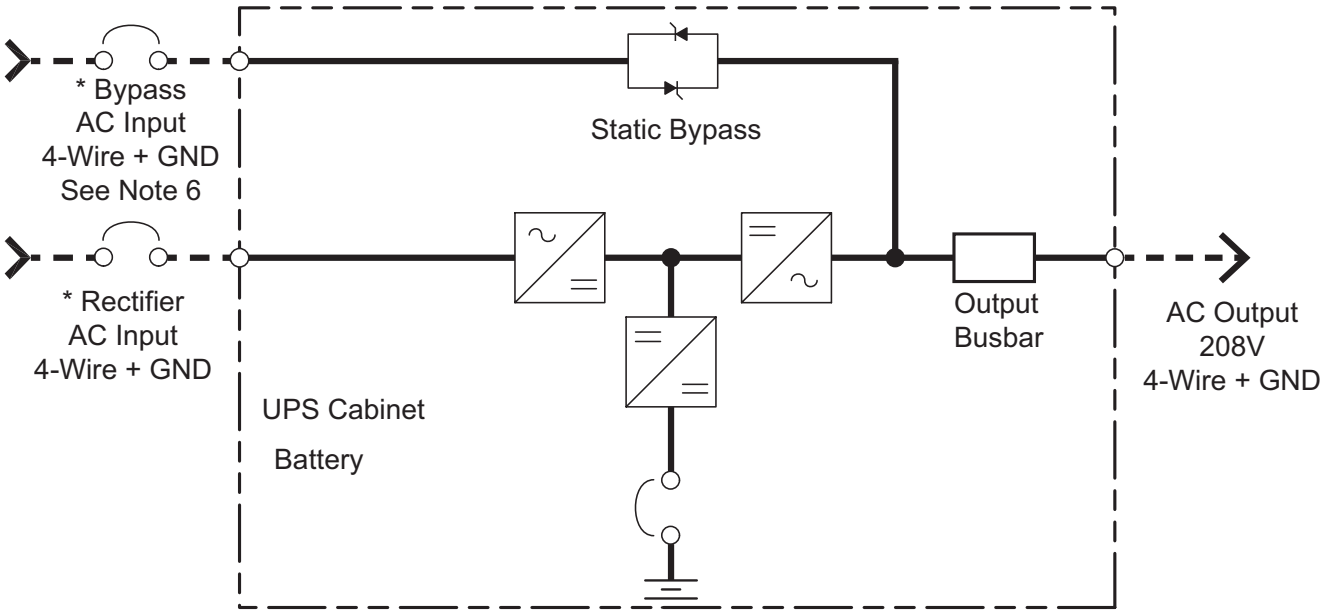
3.2.3 UPS Input Configuration

By default, the Liebert *e*XM ships with internal links installed between the bypass input and main (rectifier) input (single input configuration).

Figures 8 and **9** show the Liebert *e*XM in a split bypass (single source dual-input) configuration. In this configuration, the static bypass and the maintenance bypass lines are supplied by the same source using separate feeds. Both feeds must be protected externally with properly sized protective devices.

To wire the Liebert *e*XM as a single source dual-input UPS, remove the links and wire the bypass feed to the bypass busbars, then wire the main feed to the main busbars (see **Figure 10**).

Figure 8 Single UPS block diagram—Dual input, single source configuration, without bypass cabinet



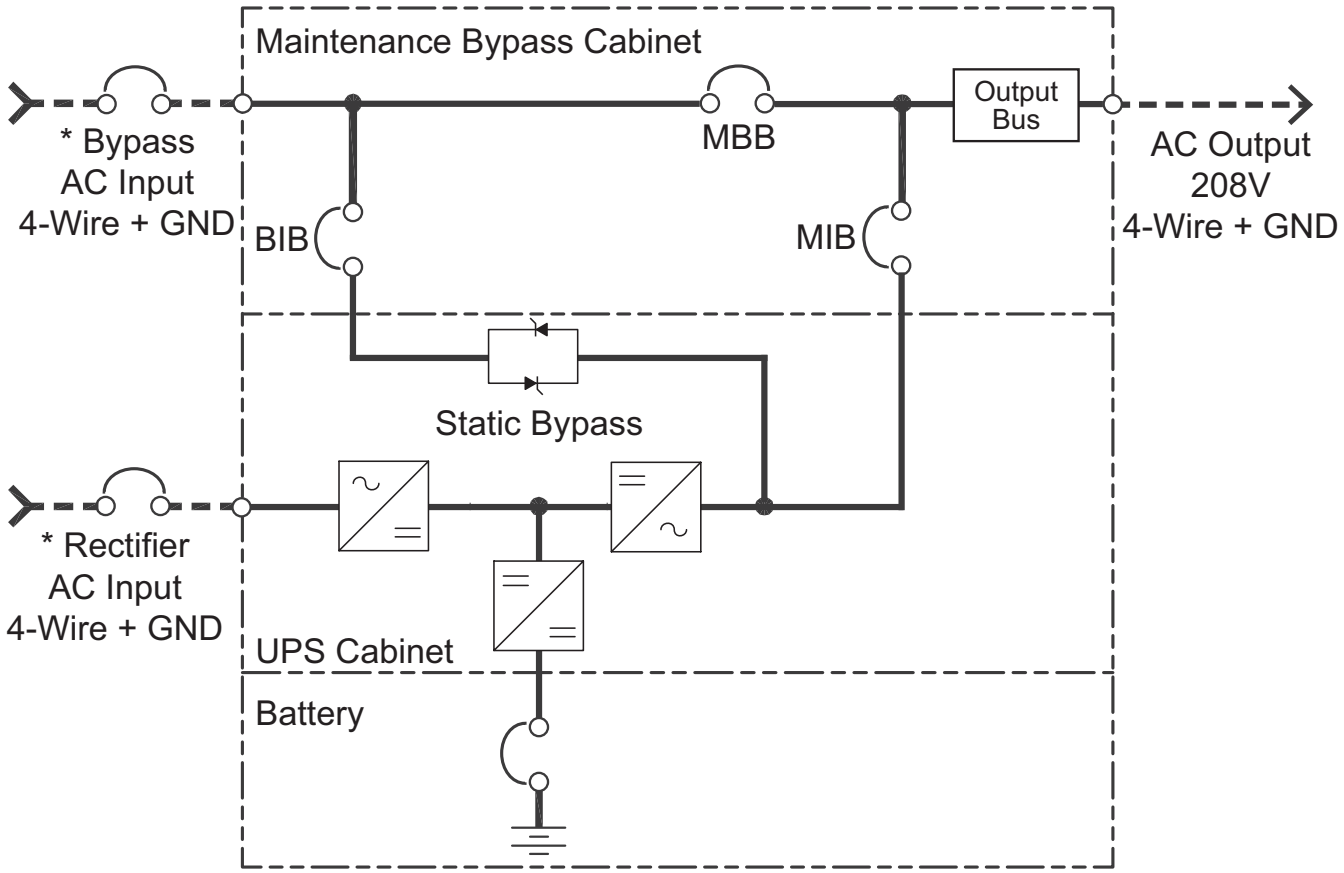
NOTES

1. Install in accordance with national and local electrical codes.
2. Input and bypass must share the same single source.
3. A neutral is required from the system AC input source. A full capacity neutral conductor is recommended. Grounding conductors are recommended.
4. Bypass and rectifier inputs and output cables must be run in separate conduits.
5. Control wiring must be run in separate conduits.
6. Customer must supply shunt trip breakers with 120V coils to the bypass.

* External overcurrent protection by others

Field-Supplied Wiring

Figure 9 Single UPS block diagram—Dual input, single source configuration with MBC



NOTES

1. Install in accordance with national and local electrical codes.
2. Input and bypass must share the same single source.
3. A neutral is required from the system AC input source. A full capacity neutral conductor is recommended. Grounding conductors are recommended.
4. Bypass and rectifier inputs and output cables must be run in separate conduits.
5. Control wiring must be run in separate conduits.
6. Customer must supply shunt trip breaker with 120V coil. If an optional Liebert MBC is not present, the shunt trip must be installed to Bypass Breaker.

BIB - Bypass Isolation Breaker
MBB - Maintenance Bypass Breaker
MIB - Maintenance Isolation Breaker
* External Overcurrent Protection by others
- - - - Field-Supplied Wiring

3.2.4 Cabling Guidelines

The following are guidelines only and are superseded by local regulations and codes of practice where applicable. Use wiring rated at 75°C or greater.

1. Take special care when determining the size of the neutral cable, as current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads. Refer to the values in **8.3 - UPS Electrical Characteristics**.
2. The ground conductor should be sized according to such factors as the fault rating, cable lengths and type of protection. The ground cable connecting the UPS to the main ground system must follow the most direct route possible. Control wiring and power wiring must be run in separate conduit. Output and input cables must be run in separate conduit.
3. Consider using paralleled smaller cables for heavy currents—This can ease installation.
4. Refer to SL-25651, the battery cabinet user manual, which shipped with the battery cabinet and is available at Liebert's Web site (**www.liebert.com**), for guidelines and instructions when sizing battery cables.
5. In most installations, the load equipment is connected to a distribution network of individually protected busbars fed by the UPS output, rather than connected directly to the UPS itself. When this is the case, the UPS output cables can be rated to suit the individual distribution network demands rather than being fully load-rated.

NOTE

If more load is added to the distribution panel, the unit's cabling must be resized.

6. When laying power cables, do not form coils; this will help avoid increasing formation of electromagnetic interference.

3.2.5 Cable Connections

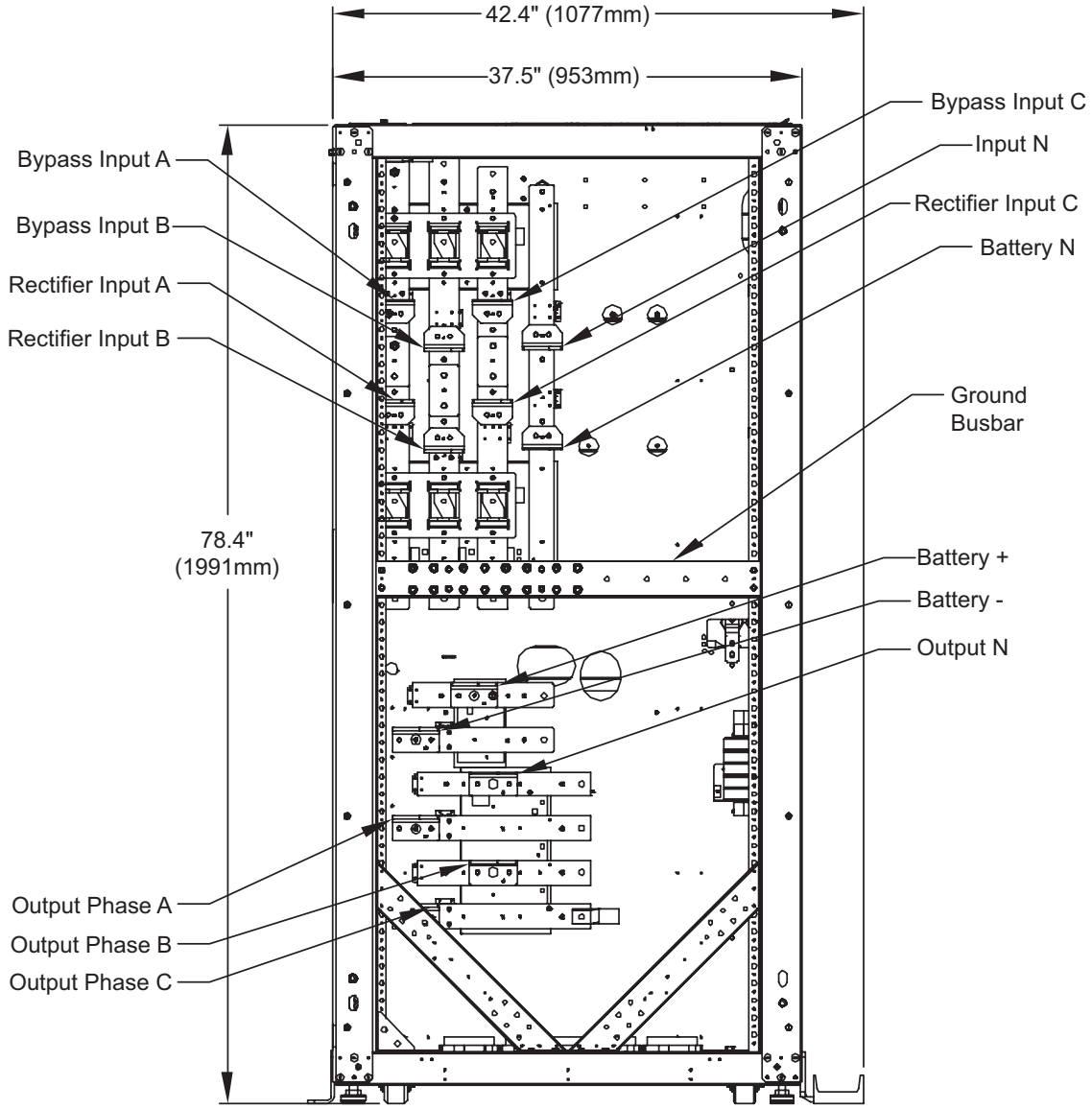
The rectifier input, bypass, output and battery are easily accessible from the front of the unit for installation. All require lug type terminations. They are connected to busbars on the front of the Liebert *e*XM, as shown in **Figure 10**. These busbars are accessible when the I/O panel is removed.

NOTICE

Risk of improper installation. Can cause equipment damage.

When wiring a single-input only system, connect only the power wiring to the input busbars.

Figure 10 Input busbars—Liebert *e*XM 120-200kVA frame



RIGHT VIEW
Panel Removed

3.2.6 Accessory Fuses and Back-Feed Breaker Wiring

Two fuse blocks provide power for the back-feed breakers (standard) and the BDSUi (optional). The fuse blocks are at the lower right of the I/O panel on the front of the Liebert *e*XM UPS. See **Figure 11** for fuse-holder locations.

The back-feed breaker fuse block provides 120V nominal provided from the UPS output (L-N) and the fuse is rated for 8 amps. **Figure 12** shows the back-feed breaker wiring, located on the bypass static switch assembly.

The Liebert *e*XM does not include internal back-feed protection. A shunt trip coil of 120V must be installed in the bypass input breaker if the system does not include a Liebert Bypass Cabinet. This is a safety feature and will prevent the UPS inverter from back-feeding the bypass source.

The BDSUi fuse block provides 208V nominal from the UPS output (L-L) and the fuse is rated at 8A. The BDSUi power wiring is shown in SL-25651, the Liebert *e*XM Battery Cabinet manual.

Figure 11 Accessory fuses

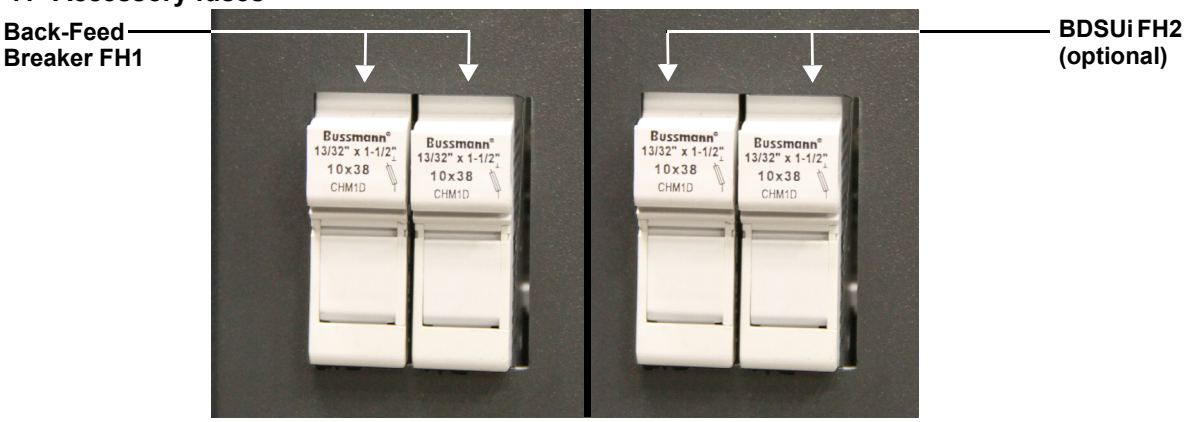
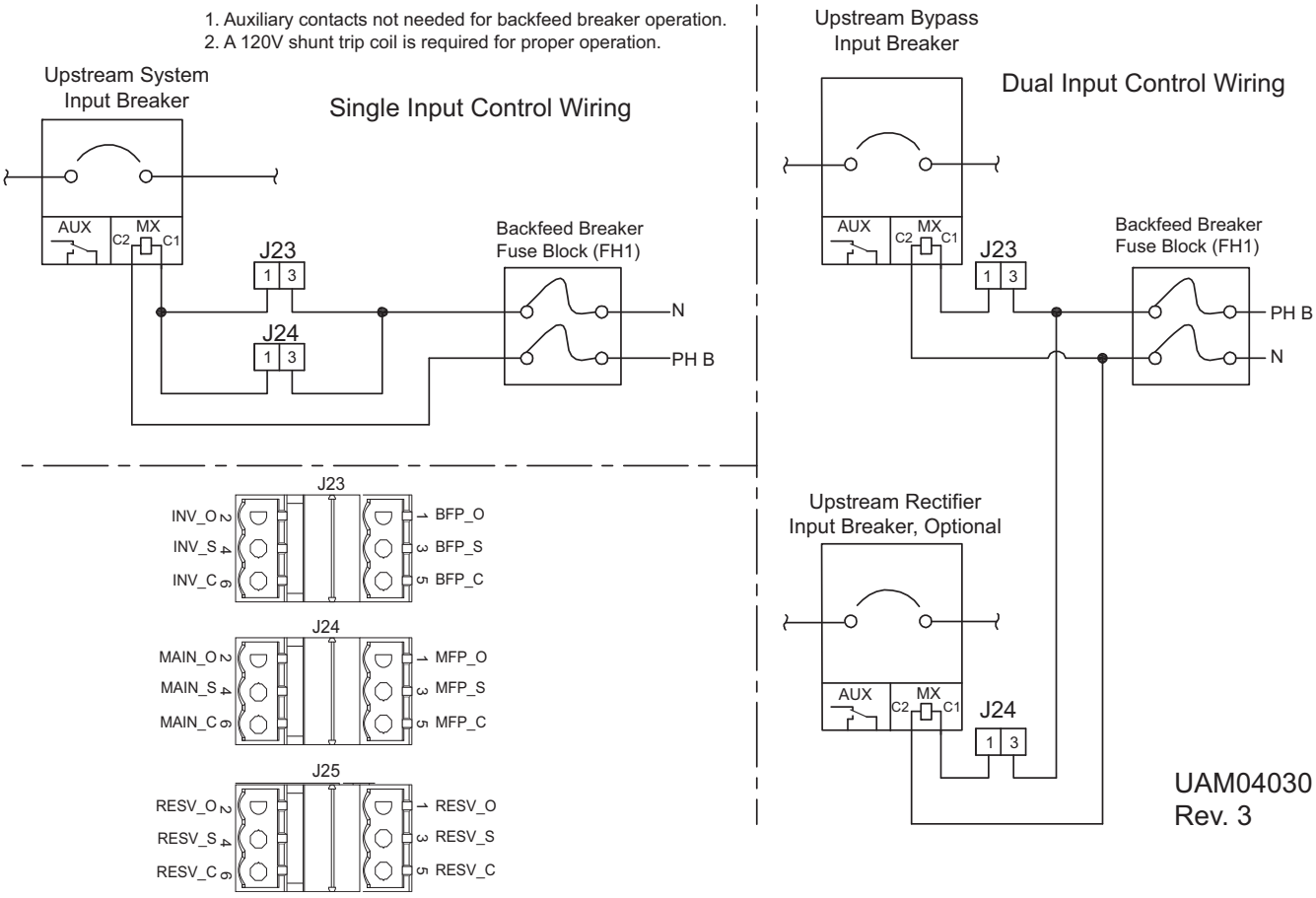


Figure 12 Dual input back-feed breaker wiring when maintenance bypass cabinet not used



NOTE

Shunt trips are required in upstream breakers to allow back-feed protection to function properly.

Shunt trip of the upstream rectifier input breaker is optional.

3.2.7 Safety Ground

The safety ground busbar is below the neutral input and output busbars as shown in **Figure 13** below. The safety ground cable must be connected to the ground busbar and bonded to each cabinet in the system. This ground busbar is then connected to the ground electrode conductor (GEC).

All cabinets and cable conduit should be grounded in accordance with local regulations.

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Failure to follow proper grounding procedures can result in electric shock hazard to personnel or the risk of fire, should a ground fault occur.

AVERTISSEMENT

Le non-respect des procédures de mise à la terre peut entraîner des risques d'électrocution du personnel, ou des risques d'incendie en cas de défectuosité de la mise à la terre.

Toutes les opérations décrites dans cette section ne doivent être effectuées que par des électriciens ou des techniciens professionnels dûment formés et qualifiés. En cas de difficultés, communiquez avec Emerson Network Power. Pour obtenir les renseignements de contact, consultez la dernière page de ce manuel.

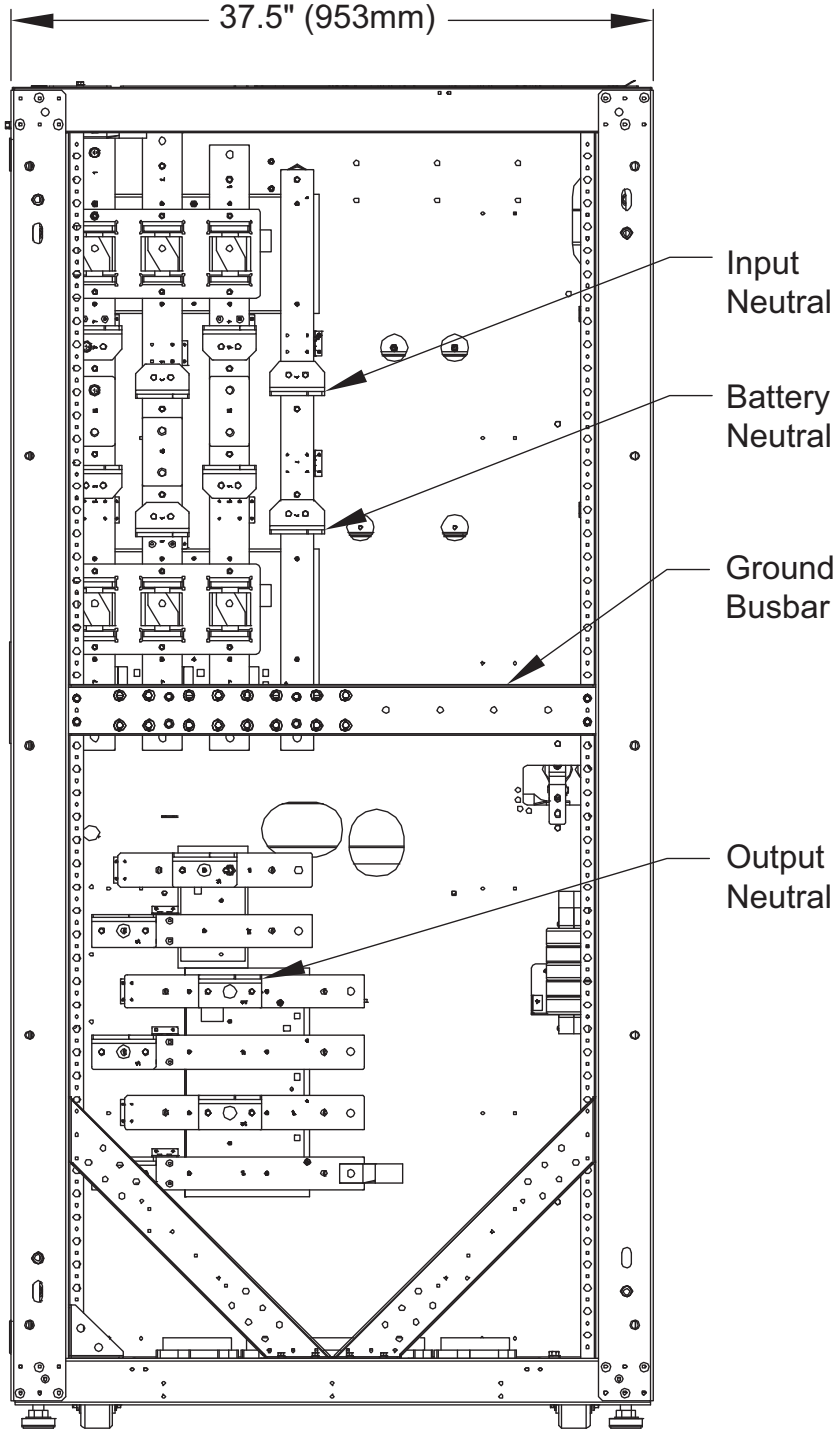
NOTE

Proper grounding significantly reduces problems caused by electromagnetic interference.

NOTE

The ground and neutral busbars are easily accessible when the I/O panel is removed. Cable connections should be made before a cabinet is attached to the right side of the Liebert e*XM or before the UPS is placed where another obstruction, such as a wall, is against the Liebert* e*XM's the right side.*

Figure 13 Ground and neutral busbar connections—120-200kVA frame busbars



3.2.8 Protective Devices

For safety, it is necessary to install circuit breakers in the input AC supply external to the UPS system. Given that every installation has its own characteristics, this section provides guidelines for qualified installation engineers with knowledge of operating practices, regulatory standards and the equipment to be installed.

UPS Rectifier and Bypass Input Supply

Protection from excessive overcurrents and short circuits in power supply input

External overcurrent protection for the AC output circuit is to be provided. See **8.3 - UPS Electrical Characteristics** and **Table 32** for overload capacity.

Overcurrent protection for the battery circuit must be provided by the customer when using an external battery cabinet not manufactured by Emerson®.

- **Dual Input Single Source**

  When wiring the UPS with dual inputs but with a single input source, the Rectifier input and the Bypass input must be protected separately. Size the breakers according to the input currents shown in **Table 25**.

NOTE

*For single or dual input, a 120V shunt trip coil(s) is required when a breaker is supplied by the customer. See **Figures 9** for details.*

Fuses

The Liebert *e*XM's main input and bypass input busbars are equipped with fuses (six locations; see **Figure 23**). The type is Bussmann 170M6466, rated 1250A.

System Output

When using an external distribution panel for load distribution, the output neutral and input neutral must be separated at the input to the UPS.

3.2.9 Cabling Procedure

CAUTION

The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficulties, contact your local Emerson representative or Liebert Services.

AVERTISSEMENT

Toutes les opérations décrites dans cette section ne doivent être effectuées que par des électriciens ou des techniciens professionnels dûment formés et qualifiés. En cas de difficultés, communiquez avec Emerson Network Power. Pour obtenir les renseignements de contact, consultez la dernière page de ce manuel.

NOTE

Hydraulic pressure pliers, combinative tools and piston ring pliers should be used to connect AC wiring.

Once the equipment has been positioned and secured for operation, and the battery and ground lugs have been connected (see **3.2.5 - Cable Connections**), connect the power cables as described below. (Study the reference drawing in **4.0 - Installation Drawings**.)

1. Verify that all incoming high and low voltage power circuits are de-energized and locked out or tagged out before installing cables or making any electrical connections.
2. Remove the front I/O panel to gain easier access to the connections busbars.
3. Connect the facility ground and ancillary ground bus cables to the copper ground busbar located in the middle of the Liebert *e*XM behind the output connections. All cabinets in the UPS system must be connected to the user's ground connection.

NOTE

The grounding and neutral bonding arrangement must comply with the National Electrical Code and all applicable local codes.

4. Identify and make power connections with incoming cables according to **Steps 5** through **8**.

Common Input Connections

5. For common bypass and main inputs, connect the AC input supply cables to the UPS input terminals (A2-B2-C2-N1) and tighten the connections to 428 lb-in. (48Nm) (M12 bolt). Ensure correct phase rotation.

NOTE

For common bypass and main inputs, the AC input cables must be connected to the bypass terminal (A2-B2-C2-N1) but not the main input terminal (A2-B2-C2).

Split Bypass Connections

6. If a split bypass configuration is used, connect the AC input supply cables to the rectifier input terminals (A1-B1-C1-N1) and the AC bypass supply cables to the bypass input terminals (A2-B2-C2-N1) and tighten the connections to 428 lb-in. (48Nm) (M12 bolt). Ensure correct phase rotation.

NOTE

For split bypass operation, ensure that the busbars between bypass and rectifier inputs are removed. The neutral line of the bypass input must be connected to that of the rectifier input.

Output System Connections—Ensure Correct Phase Rotation

7. Connect the system output cables between the UPS output busbars (A-B-C-N terminals) and the critical load and tighten the connections to 428 lb-in. (48Nm) (M12 bolt).

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

If the load equipment will not be ready to accept power when the commissioning engineer arrives, ensure that the system output cables are safely isolated.

AVERTISSEMENT

Risque de décharge électrique pouvant causer des blessures graves, voire mortelles.

Si les équipements branchés ne sont pas prêts à être alimentés à l'arrivée de l'ingénieur de mise en service, assurez-vous que les bornes des câbles de sortie du système soient isolées de façon sécuritaire.

Observe the battery cable polarity. Be sure that the battery connections, if any, are made with the correct polarity.

8. Refit all protective covers removed for cable installation.

3.3 Control Cables Details

3.3.1 Static Bypass Assembly Features

Based on your site's specific needs, the UPS may require auxiliary connections to manage the battery system (external battery circuit breaker, battery temperature sensor), communicate with a personal computer or provide alarm signaling to external devices or for Remote Emergency Power Off (REPO). Terminations for these functions are located at the front of the static bypass assembly. The main features are:

- Input and output dry contacts signal (one pair of contacts of relay)
- Emergency Power Off control (EPO)
- Environmental parameter input interface
- User communication (for data setting and user background monitor)
- Liebert IntelliSlot™ interface
- Temperature detect interface

Figure 14 Control Module connections to display cabinet and options

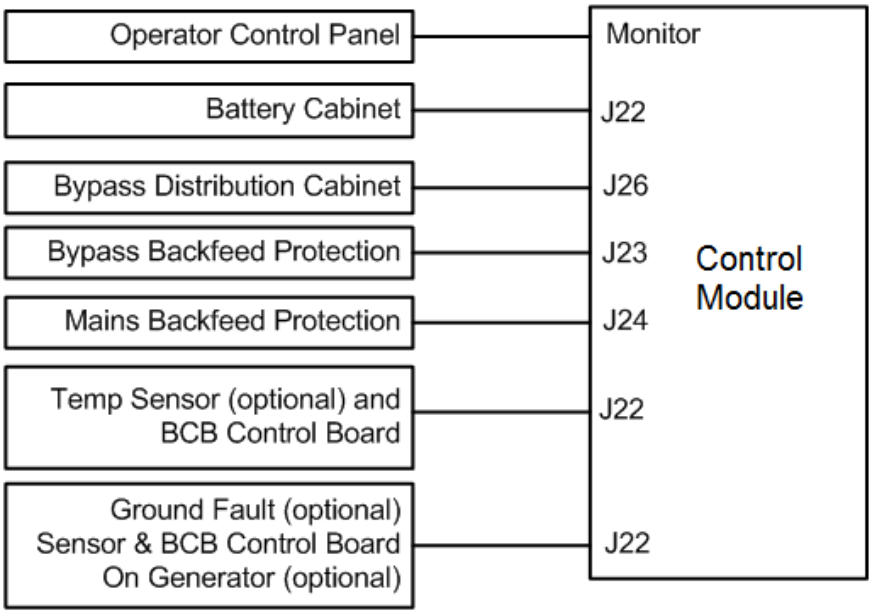
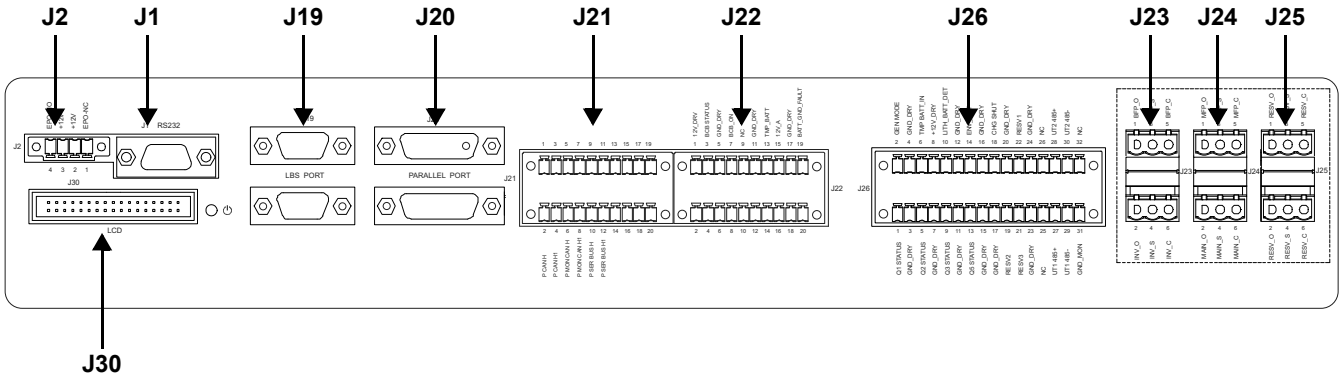


Figure 15 Auxiliary terminal block detail (control module front panel)



3.4 Dry Contacts

The UPS provides input dry contacts and output dry contacts on the Auxiliary Terminal Block (ATB).

3.4.1 Input Dry Contacts

External input dry contacts are connected via the ATB. Dry contacts are available for environment detection, battery ground fault detection, etc.

The UPS accepts external signal from zero-voltage (dry) contacts connected through external dry contact terminals produced, and these terminals are on the static bypass assembly. Through software programming, these signals become active when these contacts connect to +12V to ground (in the most left side). The cables connected to the monitor board must be separated from power cables. Moreover, these cables should be double-insulated with a typical cross-section of 0.5 to 1mm^2 for a maximum connection length between 82 and 165ft. (25-50m). The ATB has several input dry contacts.

Figure 16 Input dry contacts

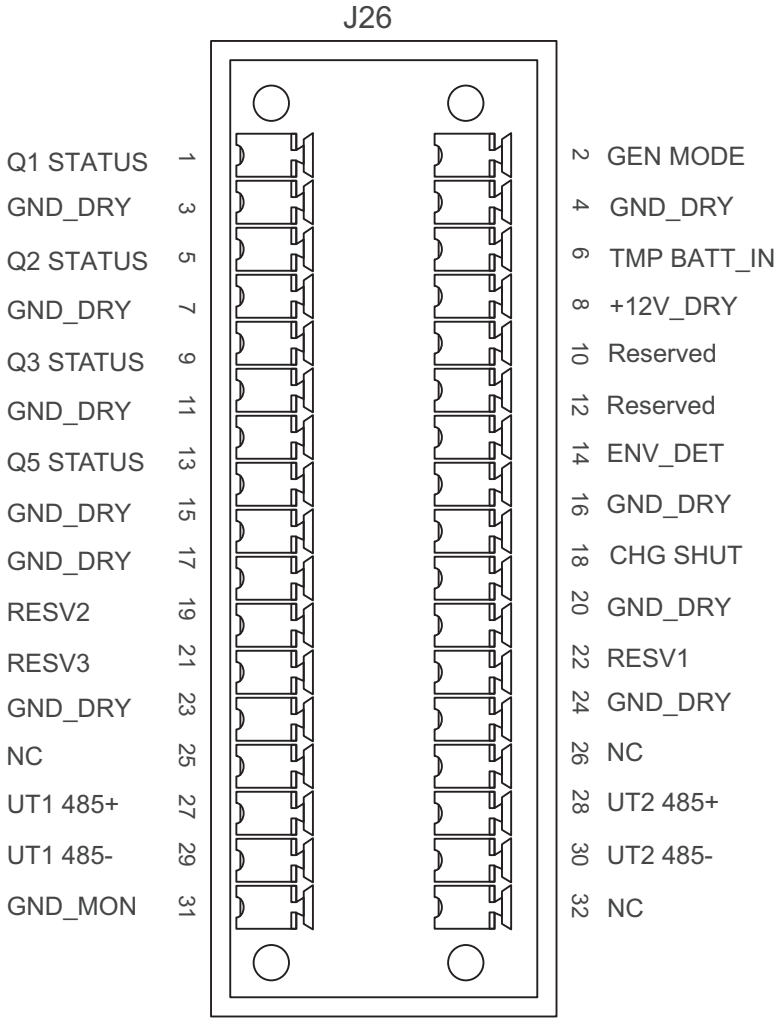


Table 5 Input dry contacts—J26

Port	Pin	Name	Description
J26	1	Q1 STATUS	The main input switch status signal
	3	GND_DRY	Dry ground
	5	Q2 STATUS	The bypass input switch status signal
	7	GND_DRY	Dry ground
	9	Q3 STATUS	External maintenance switch status signal
	11	GND_DRY	Dry ground
	13	Q5 STATUS	External output switch status signal
	15	GND_DRY	Dry ground
	17	GND_DRY	Dry ground
	19	RESV2	Reserved
	21	RESV3	Reserved
	23	GND_DRY	Dry ground
	25	NC	NC
	27	UT1 485+	485+
	29	UT1 485-	485-
	31	GND_MON	Monitor ground
	2	GEN MODE	Generator mode input. Generator mode when not connected
	4	GND_DRY	Dry ground
	6	TMP BATT_IN	Internal Battery Temperature Detect
	8	+12V_DRY	POWER
	10	Reserved	Reserved
	12	GND_DRY	Dry ground
	14	ENV_DET	Battery room temperature detect
	16	GND_DRY	Common ground
	18	CHG SHUT	Charger off contact
	20	GND_DRY	Dry ground
	22	RESV1	Reserved
	24	GND_DRY	Dry ground
	26	NC	NC
	28	UT2 485+	485+
	30	UT2 485-	485-

3.4.2 Output Dry Contacts

The Auxiliary Terminal Block has three output dry contact relays (see **Figure 17** and **Table 6**).

Figure 17 Output dry contacts and EPO wiring

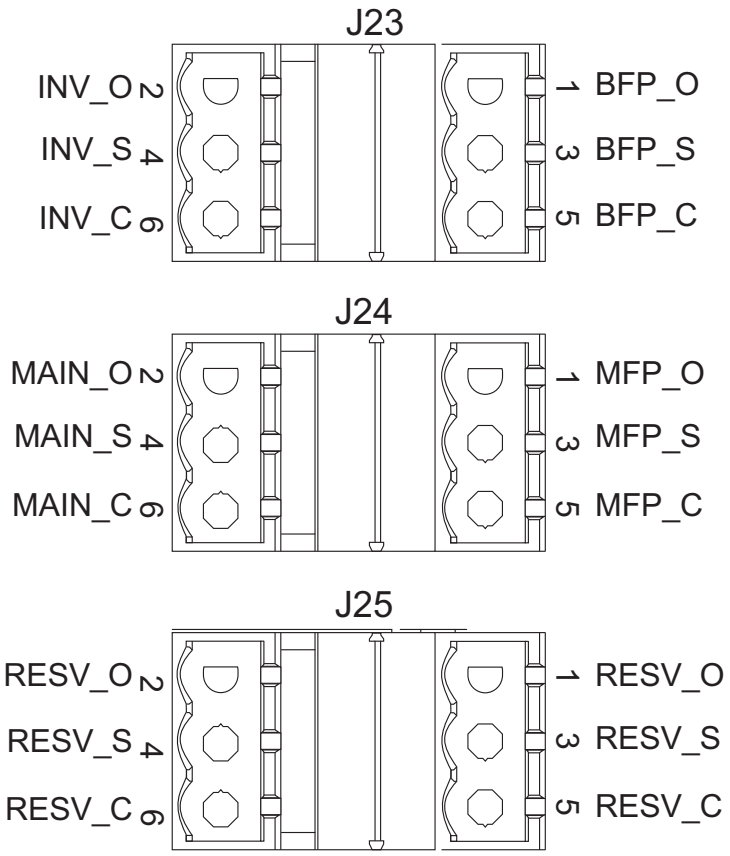


Table 6 Output dry contact relays

Port	Pin	Name	Description
J24	1	MFP_O	Rectifier back-feed normally open contact. Open when there is no back-feed.
	3	MFP_S	Rectifier back-feed common contact.
	5	MFP_C	Rectifier back-feed normally closed contact. Closed when there is no back-feed.
J23	2	INV_O	Inverter state normally open contact. Open when the inverter is abnormal.
	4	INV_S	Inverter state common contact.
	6	INV_C	Inverter state normally open contact. Closed when the inverter is normal.
J23	1	BFP_O	Bypass back-feed normally open contact. Open when there is no back-feed.
	3	BFP_S	Bypass back-feed common contact.
	5	BFP_C	Bypass back-feed normally closed contact. Closed when there is no back-feed.
J24	2	MAIN_O	Rectifier input state normally open contact. Open when the rectifier is abnormal.
	4	MAIN_S	Rectifier input state common contact.
	6	MAIN_C	Rectifier input state normally closed contact. Closed when the rectifier is normal.

NOTE

All auxiliary cables of terminal must be double-insulated. Wire should be 20-16AWG stranded for maximum runs between 80 and 200 feet (25-60m), respectively.

3.4.3 Liebert MBC Interface

The Liebert MBC interface is on the Auxiliary Terminal Block at J26. Refer to **Figure 16** for circuit details.

Table 7 Liebert BDC interface

Position	Name	Description
J26.1	Q1 STA	Main input switch status signal
J26.5	Q2 STA	Bypass input switch status signal
J26.9	Q3 STA	External maintenance switch status signal
J26, 3, 7, 9	GND	Ground for dry contacts

These contacts cannot be active unless they are set via software.

NOTE
All auxiliary cables of terminal must be double-insulated. Wire should be 20-16AWG stranded for maximum runs between 80 and 200 feet (25-60m), respectively.

NOTE
Refer to SL-25652, the Liebert eXM Maintenance Bypass Cabinet manual for the Liebert MBC wiring.

3.4.4 Battery Cabinet Interface Connectors

The battery cabinet interface is on the Auxiliary Terminal Block at J22. Refer to **Figure 18** for circuit details.

Figure 18 Battery cabinet interface—J22

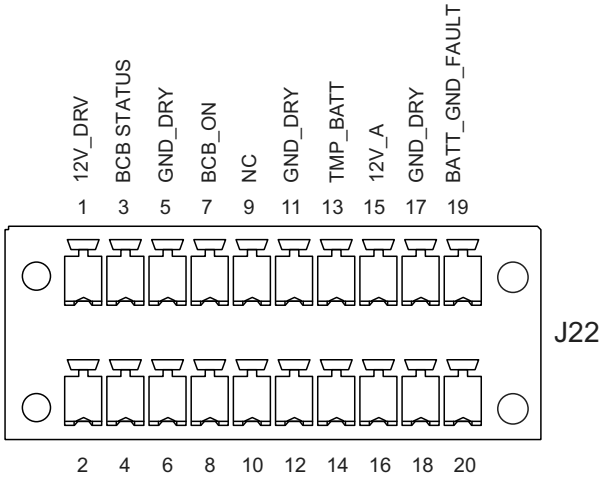


Table 8 Battery cabinet interface—J22

Pin	Name	Description
1	12V_DRV	BCB driver signal
3	BCB STATUS	BCB state signal
5	GND_DRY	Dry ground
7	BCB_ON	BCB on line signal
9	NC	NC
11	GND_DRY	Dry ground
13	TMP_BATT	External Battery temperature
15	12V_A	Power
17	GND_DRY	Dry ground
19	BATT_GND_FAULT	Battery ground fault signal

NOTE
All auxiliary cables of terminal must be double-insulated. Wire should be 20-16AWG stranded for maximum runs between 80 and 200 feet (25-60m), respectively.

3.4.5 EPO Input—Optional

NOTICE

Risk of exceeding internal voltage limits. Can cause equipment damage.

Do not apply more than 12V to the Emergency Power Off (EPO) input. Exceeding 12V on this input can damage the Liebert *e*XM's internal circuitry and control boards. Exceeding 12V will also put the Liebert *e*XM in an EPO state, and the unit will not reset, making it non-functional.

The UPS has an Emergency Power Off (EPO) function operated by a button on the control panel or by a remote contact provided by the user. The EPO button is under a hinged, clear plastic shield.

The J2 connector, shown in **Figure 19**, is the remote EPO input interface. The EPO has NO/NC contacts that become active when shorting terminals J2: 3 and 4 or open terminal connection J2:2 and 1.

If an external Emergency Stop capability is required, it is connected at terminals J2: 1 and 2 and at J2: 3 and 4 on the monitor board. It also is connected to the Normally Open or Normally Closed remote stop switch between these two terminals using shielded cable (see **Figure 19** and **Table 9**). If this function is not used, terminals J2:3 and 4 must be opened and J2:1 and 2 must be closed.

Figure 19 EPO wiring and signal names for J2

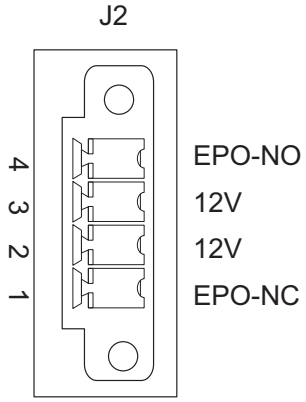


Table 9 EPO input contact relays—J2

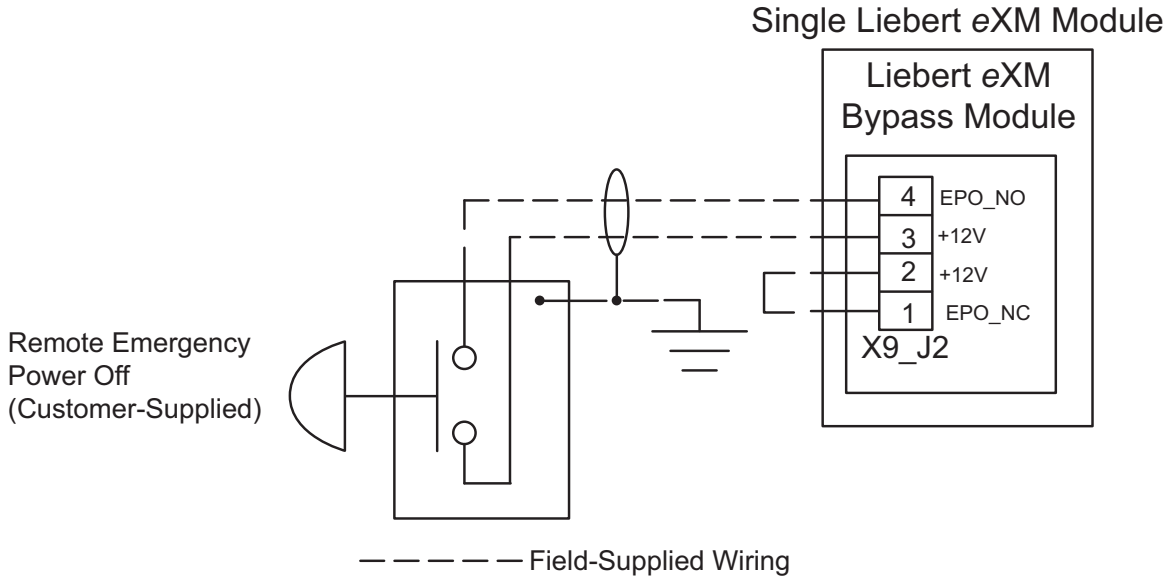
Pin	Name	Description
1	EPO-NC	EPO activated when opened to Pin 2
2	+ 12V	EPO activated when opened to Pin 1
3	+ 12V	EPO activated when shorted to Pin 4
4	EPO-NO	EPO activated when shorted to Pin 3

NOTE
The Emergency Stop action within the UPS shuts down the rectifier, inverter and static bypass. It does not internally disconnect the input power supply. To disconnect ALL power to the UPS, open the upstream feeder breaker(s) after the remote EPO is activated.

NOTE
Normally Closed EPO – J2: 12, these terminals are supplied factory-linked on the Bypass Module on the UPS and must remain installed if using NO contacts.

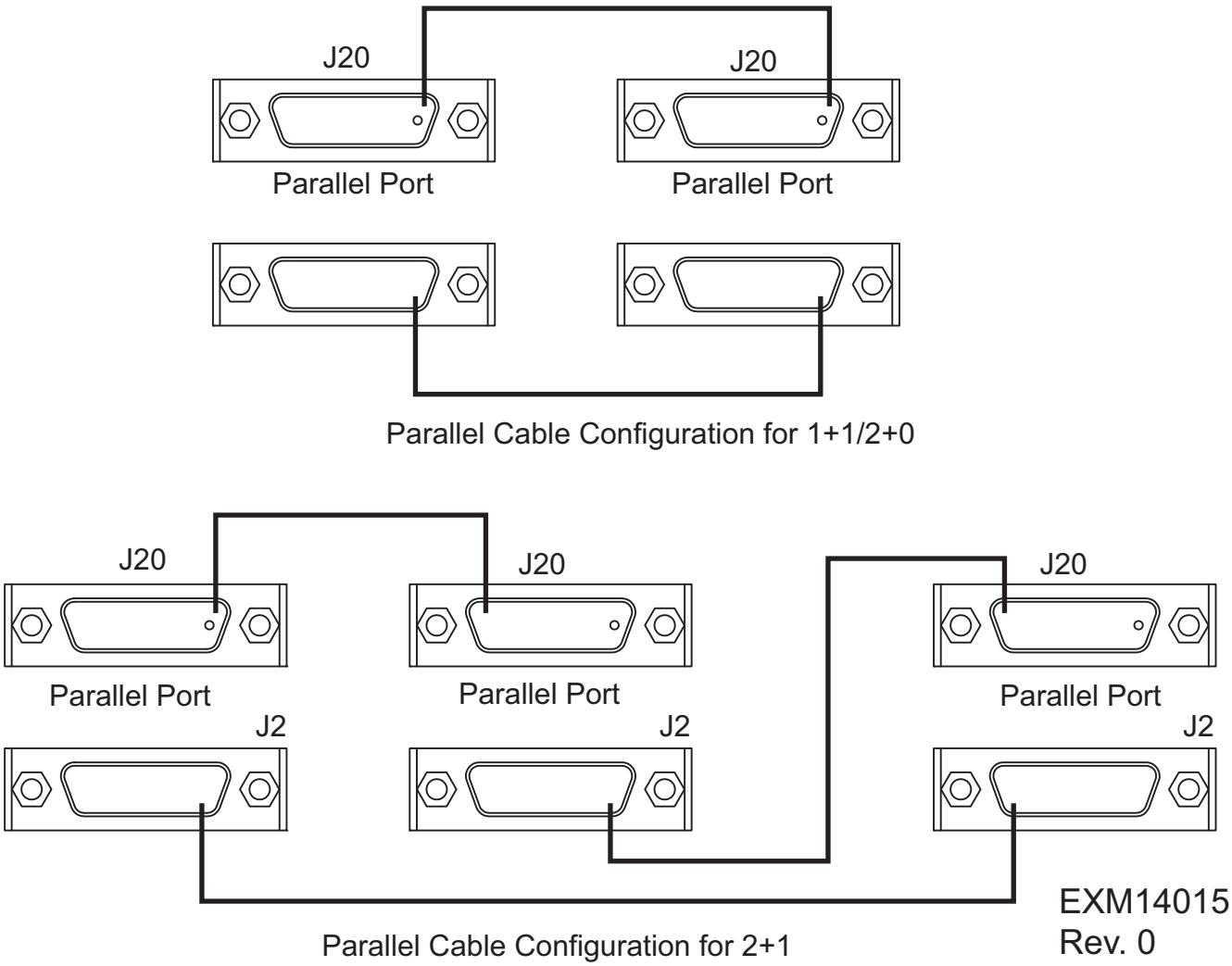
NOTE
All auxiliary cables of terminal must be double-insulated. Wire should be 20-16AWG stranded for maximum runs between 80 and 200 feet (25-60m), respectively.

Figure 20 Single UPS Remote Emergency Power Off



3.5 Parallel Cable Connections

Figure 21 Parallel cable wiring diagram



4.0 INSTALLATION DRAWINGS

The diagrams in this section illustrate the key mechanical and electrical characteristics of the Liebert *e*XM UPS System cabinets (UPS, Liebert MBC and battery).

Figure 22 UPS dimensions—front view

NOTES

1. Dimensions are in inches (mm)
2. 24" (610mm) minimum clearance above unit required for air exhaust. No clearance required in rear except when using seismic anchoring, allow 5" (127mm) clearance. 36" (914mm) front access required for service.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates. Remove, punch to suit conduit size and replace.
5. Unit bottom is structurally adequate for forklift handling.
6. Control wiring and power wiring must be run in separate condutis.
7. All wiring is to be in accordance with national and local electrical codes.
8. All battery cabinets must be positioned on the left side of the UPS.

Figure 23 UPS main components—typical 120-200kVA unit

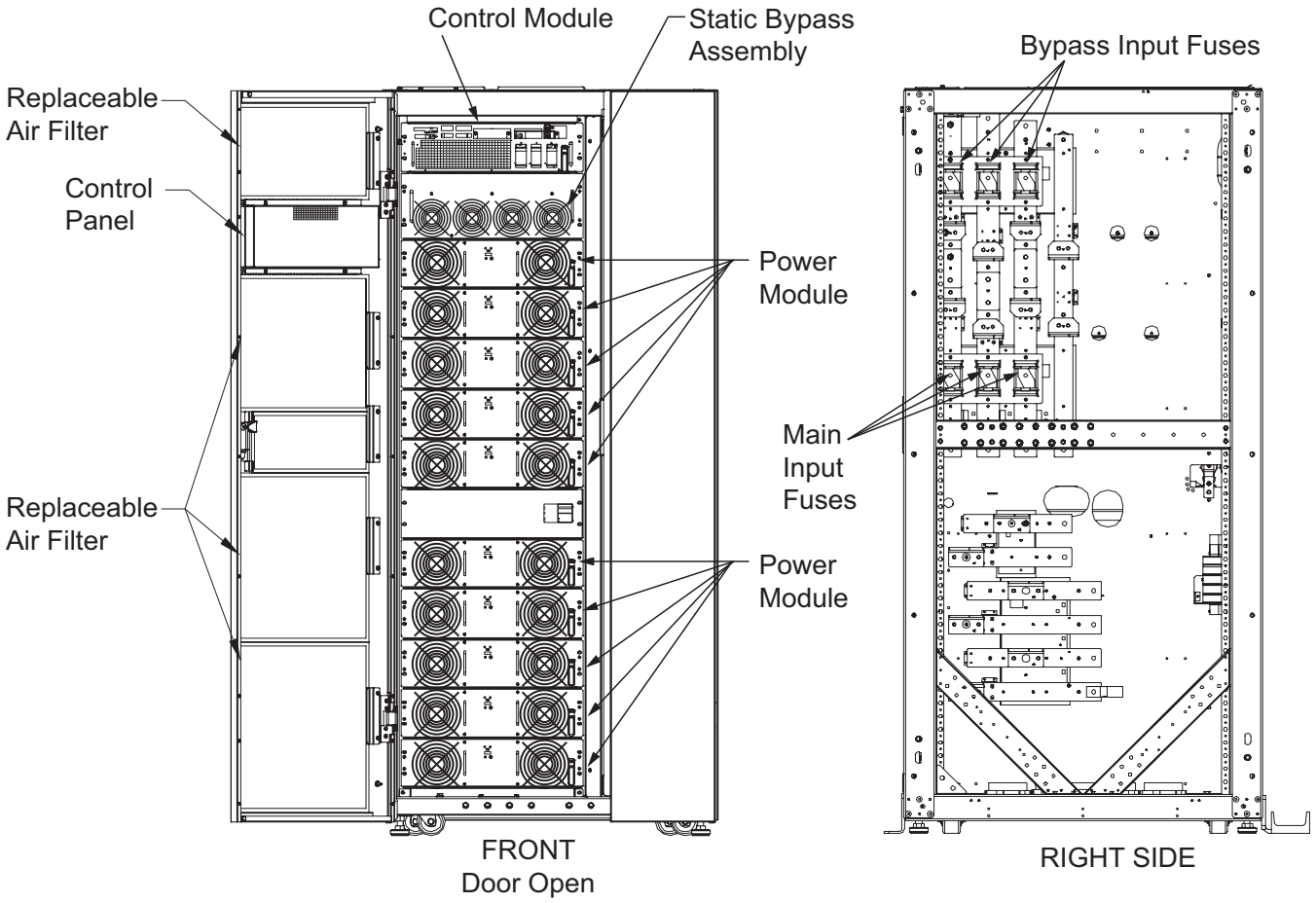
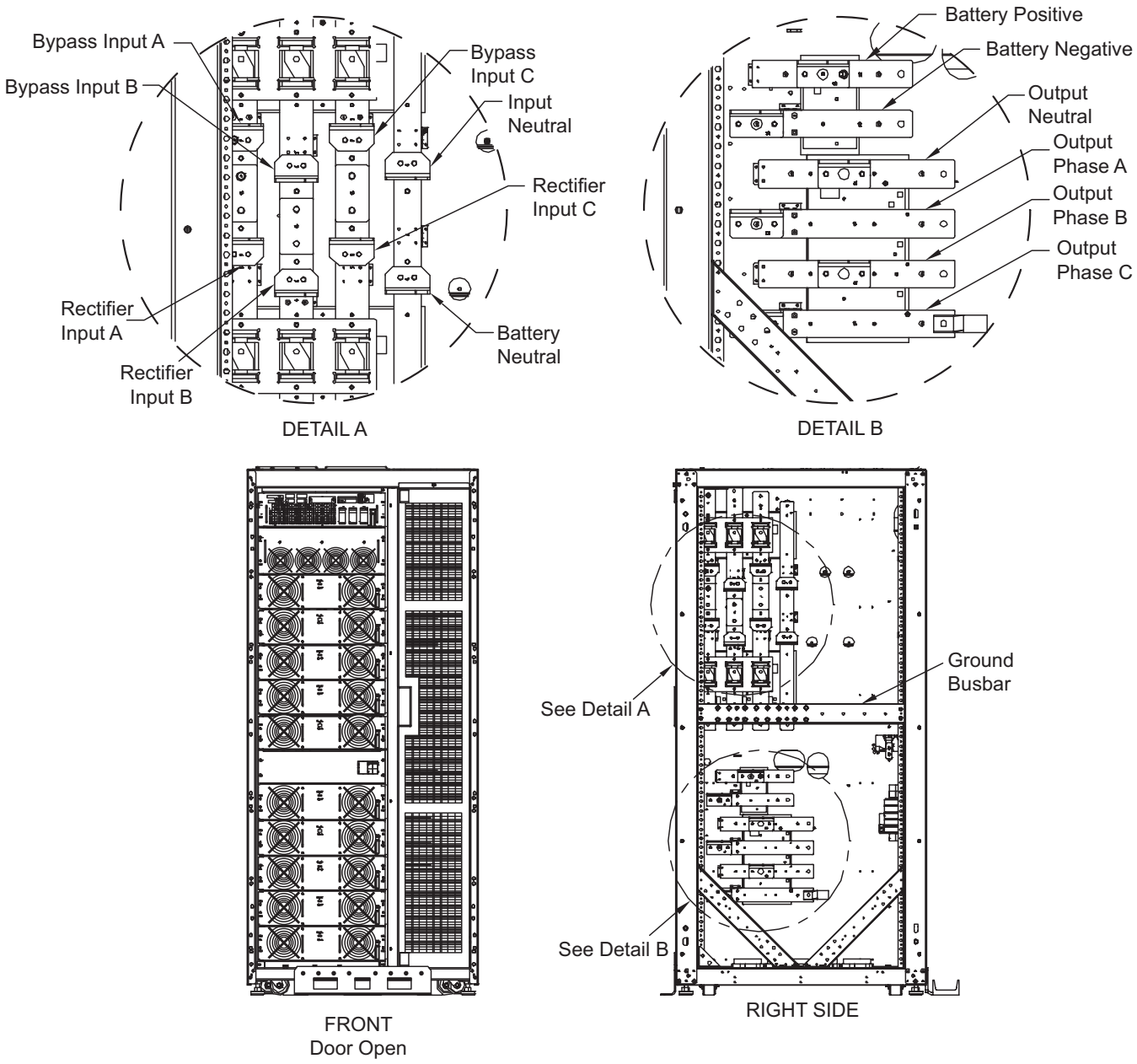


Figure 24 UPS cable connections—120-200kVA frames



5.0 OPTION INSTALLATION

5.1 Liebert IntelliSlot™ Communication

The Liebert *e*XM has three Liebert IntelliSlot ports to allow field-installation of optional communication cards. Liebert IntelliSlot cards communicate via Liebert's proprietary Velocity protocol to cards that translate the information into such protocols as SNMP and Modbus. Other cards provide dry contact signals for external signaling of operating status.

The Liebert IntelliSlot communication ports may be installed or removed while the Liebert *e*XM is operating.

5.2 Liebert IntelliSlot Web Card—SNMP/HTTP Network Interface Card

This network interface card provides all real-time data and status information as SNMPv1 traps for connection to a 10/100-baseT Ethernet connection. The same card also will transmit the same status information and all measured parameters for display via a Web browser. The Liebert IntelliSlot bays are on the right side of the control module and labeled as IntelliSlot1, IntelliSlot2 and IntelliSlot3.

Table 10 Liebert *e*XM communication options

Port Type and Location	Labeled ID Name of Port	Monitoring Devices Supported
Left Liebert IntelliSlot	IntelliSlot 1	IS-Relay
		IS-Unity-DP
		IS-Unity-LIFE
		IS-485EXI
Center Liebert IntelliSlot	IntelliSlot 2	IS-Relay
		IS-Unity-DP
		IS-Unity-LIFE
		IS-485EXI
Right Liebert IntelliSlot	IntelliSlot 3	IS-Relay
		IS-Unity-DP
		IS-Unity-LIFE
		IS-485EXI

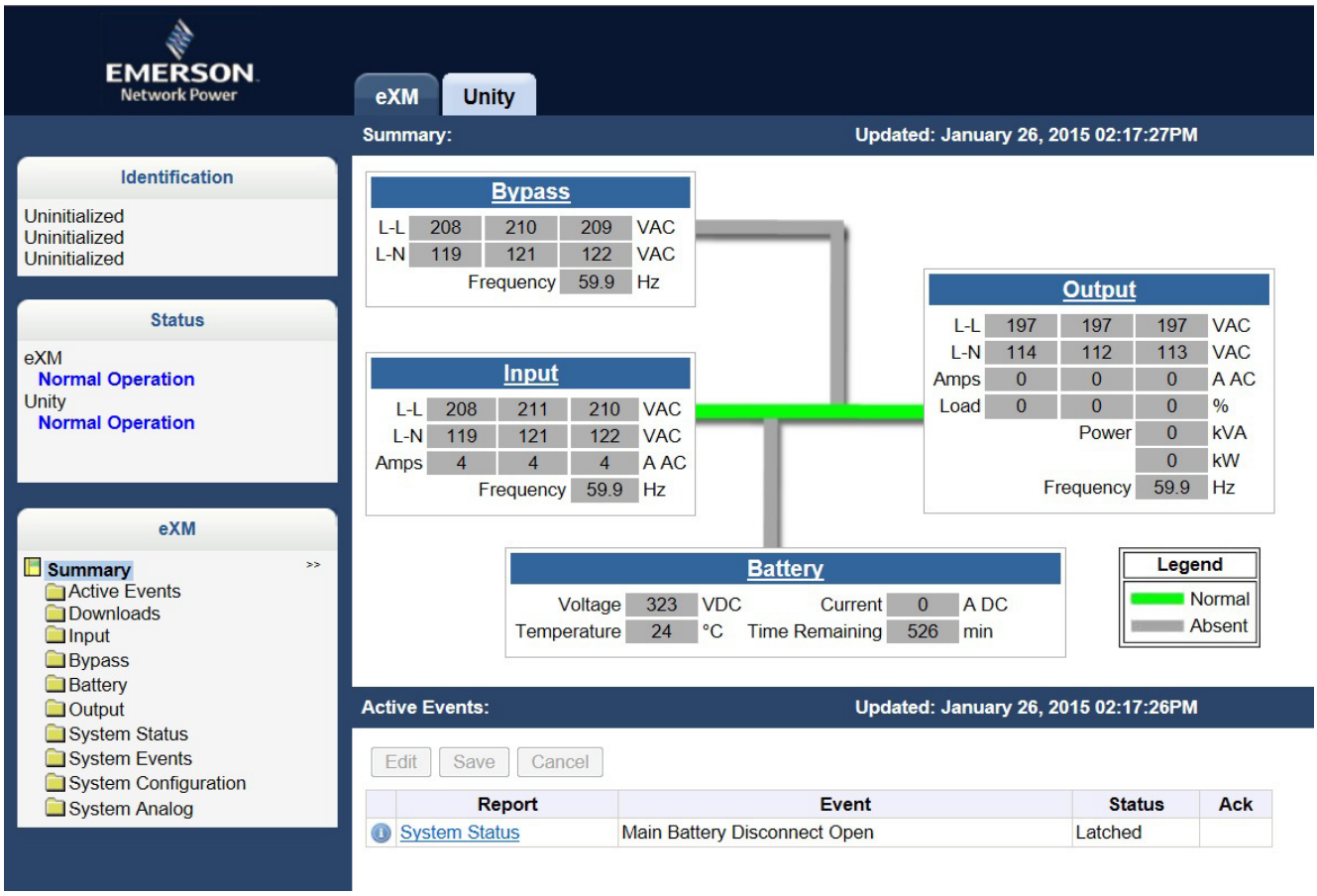
5.2.1 Liebert IntelliSlot™ Unity Cards—IS-UNITY-LIFE, IS-UNITY-S, IS-UNITY-DP

- **IS-UNITY-LIF**E: This standard card is used for communication between the Liebert *e*XM and Emerson's Trellis® NMS and LIFE™ services.
- **IS-UNITY-DP**: This card can be used instead of the standard card if communication to two third-party platforms is required. Third-party platforms include SNMP and 485 (Modbus/Bacnet) protocols. This card would still be used for communication between the Liebert *e*XM and Emerson's Trellis NMS and LIFE Services. All communication protocols are active simultaneously.
- **Liebert IntelliSlot Dry Contact Card (IS-RELAY)**: Provides dry contact alarm information, including: On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS signals for communication to a remote monitoring system or for use with Liebert MultiLink® software.
- **IS-485EXI**: The Liebert IntelliSlot 485 EXI Card provides connection to a Liebert SiteLink-E™ allowing Liebert SiteScan® Web 4.0 monitoring and control of your Liebert equipment.

5.3 Liebert IntelliSlot Web Card—Optional

An optional Web card is available that provides remote access to the UPS. A wide variety of status and summary information is available through an Ethernet connection.

Figure 25 Liebert IntelliSlot Web card display



5.4 Liebert IntelliSlot™ Relay Card

The Liebert IntelliSlot Relay card (IS-RELAY) provides voltage-free contact closures for remote monitoring of alarm conditions.

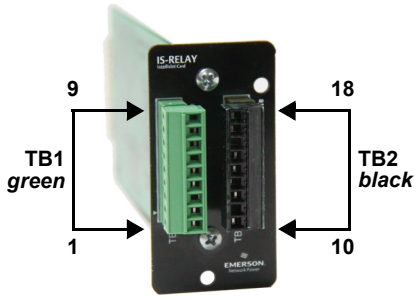
Delivering **On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault** and **On UPS** signals, the easy-to-install card integrates with AS/400 computers (additional cable required) and other relay contact monitoring systems.

The relay card is rated for 24 VAC/DC at 1A. and supported in any of the three Liebert IntelliSlot bays on the Liebert *e*XM.

5.4.1 Liebert IntelliSlot Relay Card Pin Configuration

The card has two terminals blocks, TB1 (green, numbered 1-9) and TB2 (black, 10-18), as shown in **Figure 26**.

Figure 26 Pin location and numbering



Refer to your Liebert product user manual for the pin configuration for the terminal blocks.

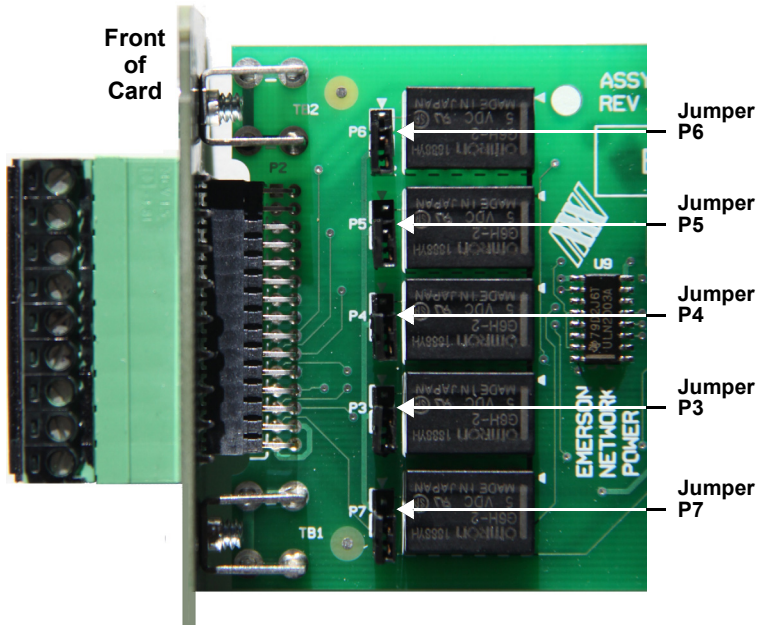
Table 11 Relay card pin configuration

Pin	Function	Operation
1	Common - Low Battery	—
2	Low Battery	Closed if Low Battery point occurs.
3	Low Battery	Closed if battery is OK
4	Common - UPS Fault	—
5	UPS Fault	Closed if UPS fault occurs
6	UPS Fault	Closed if no UPS failure
7	Common - On Battery	—
8	On Battery	Closed if On Battery power (Utility failure)
9	On Battery	Closed if not On Battery power (Utility OK)
10	Not Used	—
11	Not Used	—
12	Not Used	—
13	Summary Alarm*	Closed if no alarm conditions are present
14	Summary Alarm*	Closed if Summary Alarm occurs
15	Common - Summary Alarm*	—
16	On UPS	Closed if On UPS (inverter) power
17	On Bypass	Closed if On Bypass
18	Common - On Bypass	—

5.4.2 Liebert IntelliSlot™ Relay Card Jumper Setup

The Liebert IntelliSlot Relay Card has five jumpers, P3 through P7, as shown in **Figure 27**. Each jumper connects two pins.

Figure 27 Jumper location and numbering



By default all five jumpers have shunts installed. The two pins are shunted together to provide the functions shown in **Table 12**, allowing relay commons to be tied together.

The jumpers should be removed if there is any external voltage source that may intentionally or inadvertently be connected to the relay.

Removing the shunt from any two pins breaks the connection between the relay commons so they are not tied together.

Table 12 Jumper connections

Jumper	Relay
P6	On Battery
P5	UPS Fault
P4	Low Battery
P3	On Bypass
P7	Summary Alarm

NOTE

Refer to the Liebert IntelliSlot Relay Card manual, SL-23211 for additional details. the document is available at the Liebert Web site, ***www.liebert.com***

6.0 OPERATOR CONTROL AND DISPLAY PANEL

6.1 Operator Control Panel

The control panel and LCD on the front of the Liebert *e*XM lets the operator:

- Turn the UPS On or Off.
- Transfer into the various operating modes.
- Silence alarms.
- Check the status of the UPS and its external batteries, including all measured parameters, events and alarms.

The main areas of the control panel are shown below in **Figure 28** and explained in **Table 13**.

- **Mimic Display** - view the status of the Liebert *e*XM in single-line diagram format—indicators show status by changing color when ON, flashing or OFF
- **Liquid Crystal Display (LCD)** and **Navigation keys** - view status and operational data from the Liebert *e*XM in tabular format
- **Control buttons** - turn the Liebert *e*XM On or Off, silence alarms

Figure 28 Overview of control panel

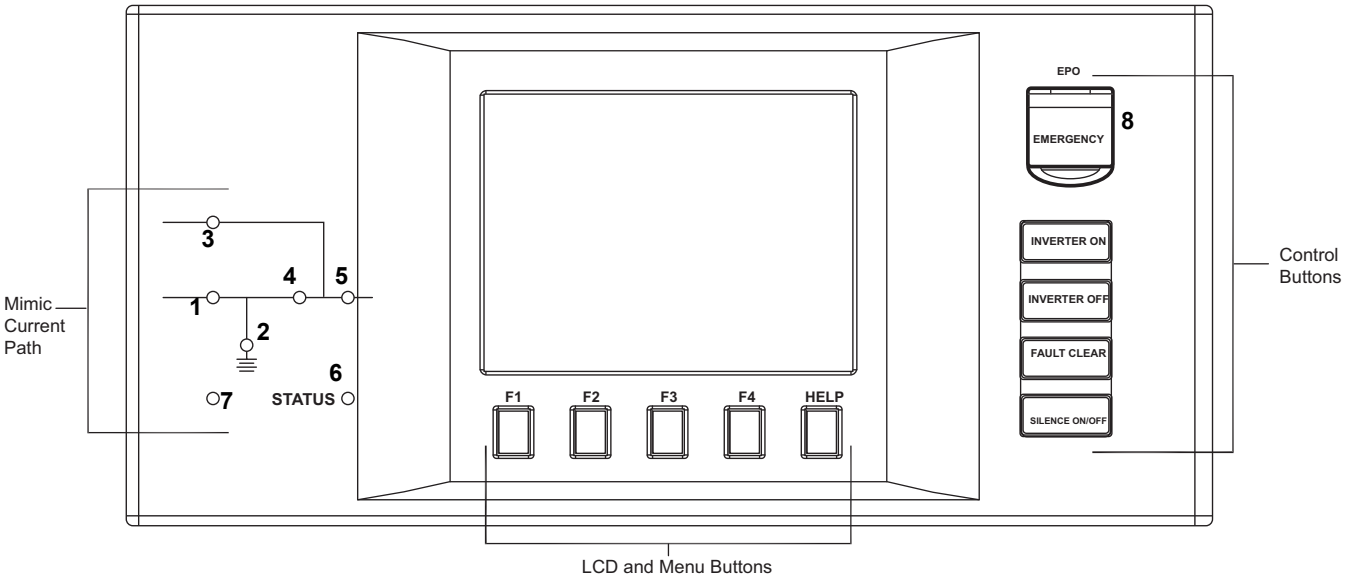


Table 13 Descriptions of UPS operator control and display panel

Mimic Current Path	
Item #	**Function**
1	Rectifier indicator (AC to DC)
2	Battery indicator (backup DC power)
3	Bypass input indicator
4	Inverter indicator (DC to AC)
5	Load indicator (AC output)
6	UPS status and alarm indicator
7	Audible alarm (buzzer)
8	Protective cover for EPO button

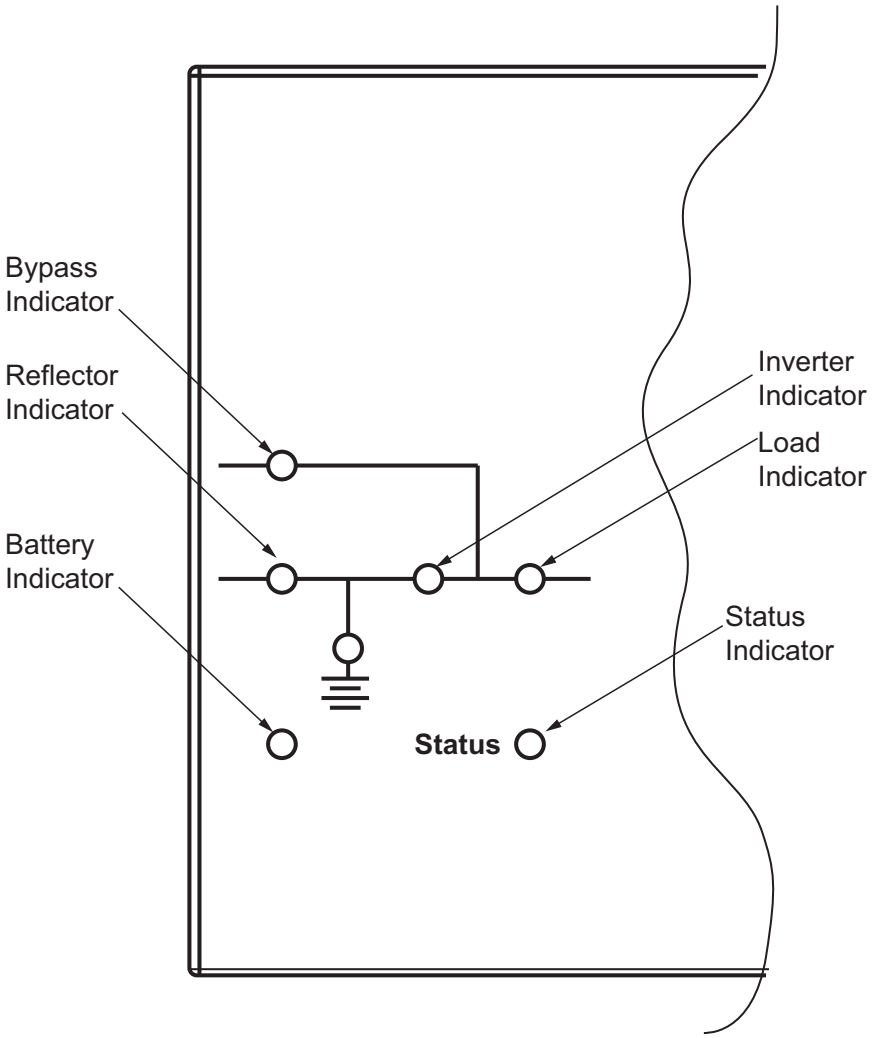
Control Buttons	
Button	**Function**
EPO	EPO switch
INVERTER ON	Inverter start button
INVERTER OFF	Inverter shutdown button
FAULT CLEAR	Fault reset button
SILENCE ON/OFF	Alarm mute button
Menu Buttons	
Button	**Function**
F1 through F4 and HELP	LCD menu keys

NOTE

Help button menus are not active. Future units will ship with an F5 legend in place of the HELP legend.

6.2 Mimic Display Indicators

Figure 29 Mimic display indicators location



Mimic indicators show the operational status of the Liebert *e*XM by their color—green, amber or red—and whether they are On (solid), flashing or Off. **Table 14** provides a guide to interpreting the various states of the indicators.

Table 14 Mimic display status indicators

Indicator (see Figure 29)	Green	Flashing Green / Amber	Red	Off
1. Rectifier	Load on Rectifier	Flashing Green: Utility normal, but rectifier not operating	Rectifier fault	Rectifier is normal, but utility is abnormal
2. Battery	Battery Powering the Load	Flashing Green: Battery pre-warning (low battery)	Battery or battery converter abnormal*	Battery and converter are normal, and battery is not discharging
3. Bypass	Load on Bypass Power	—	Bypass out of normal range	Bypass Normal
4. Inverter	Inverter Powering the Load Normally	Flashing Green: Inverter on standby	Inverter fault	Inverter normal but Off
5. Load	UPS output On	—	UPS output overloaded	UPS has no output power
6. Status	No Alarms—UPS Working Normally	Amber: UPS has a general alarm	UPS has a serious alarm	—

* Battery or battery converter abnormal events include these event messages (see **Table 41** in **Appendix B**): No Battery, Battery Replaced, Battery Reverse, Batt. Conv. Over. Curr., Batt. Converter Fault, Batt. Converter Overtemp.

6.3 Control Buttons

The **Control Buttons** on the front panel may be used to shut down the UPS completely, turn the inverter on or off, restart the UPS after a fault and silence the alarm, as shown in **Figure 30**. The function of each button is described in **Table 15**.

NOTE
To activate a button properly, press and hold until you hear a short beep—about two seconds.

Figure 30 Control button layout

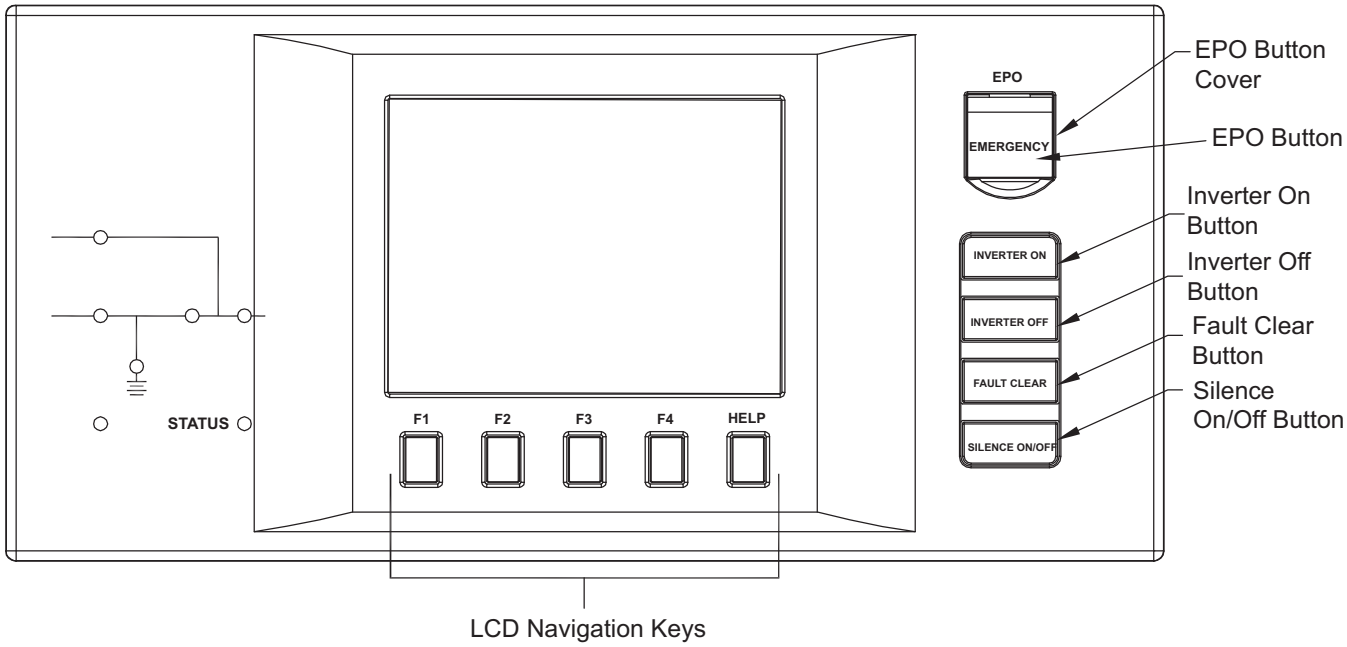


Table 15 Control buttons

Button (see Figure 30)	Function
EPO	Completely shuts down the UPS, including the static switch. **CAUTION:** Use caution before pressing the Emergency Power Off (EPO) button. This button completely shuts down the unit and the critical load.
INVERTER ON	Press this button to start the inverter and transfer from static bypass to inverter. **NOTE:** If the inverter is not ready, this will not activate the UPS.
INVERTER OFF	Press this button to shut down the inverter during operation. The load will be transferred to static bypass.
FAULT CLEAR	After the UPS shuts down due to a fault and the alarm condition has been resolved, press this button to clear the fault and restart the UPS.
SILENCE ON/OFF	Press this button once to silence the alarm buzzer when an alarm is active. Any new fault will sound the buzzer again. If the alarm buzzer is not beeping, press this button to test the alarm sound.

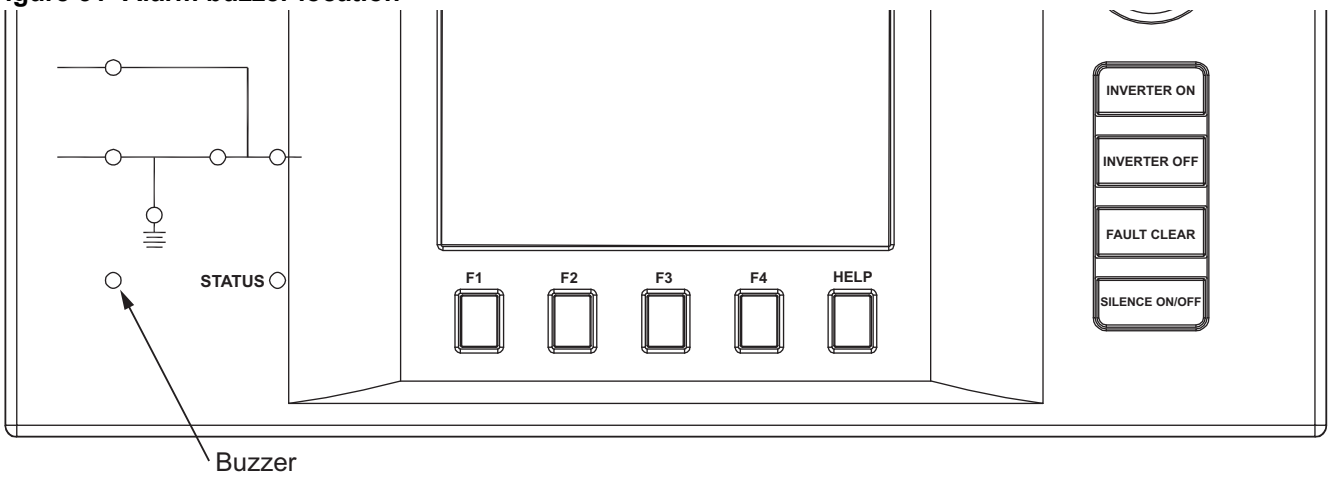
6.4 Alarm Buzzer

The alarm buzzer produces three types of sounds:

- **Single beep** - when any Control button is pressed
- **Single beep repeating every two seconds** - the system has a general alarm
- **Continuous** - the system has a serious fault

If the alarm buzzer makes no sound, the system may be operating properly or the alarm may have been silenced manually.

Figure 31 Alarm buzzer location



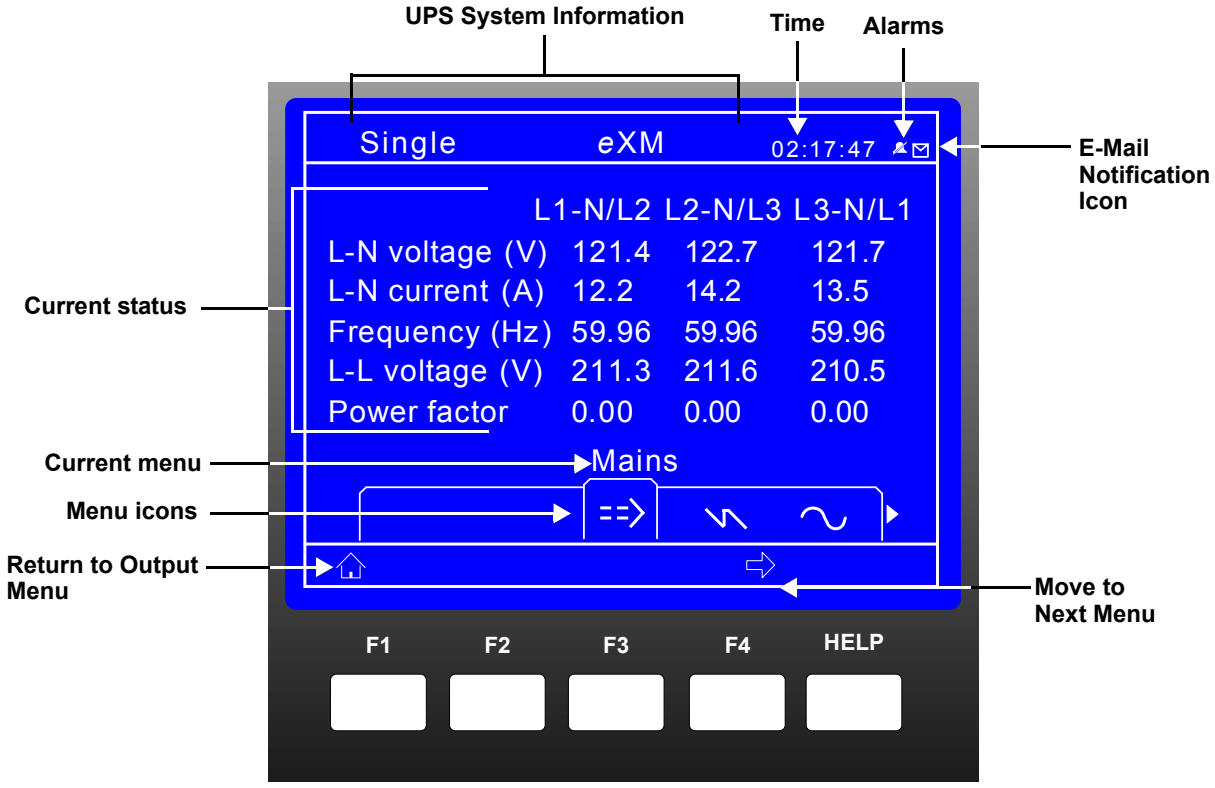
6.5 LCD Overview

The LCD on the front panel has five main sections, as shown in **Figure 32**. Press the F1 key below the LCD to scroll through these sections.

- **UPS system information** - view UPS name and model, date and time, overall status.
- **LCD Menu** - choose a category of data items to appear below the menus (see **Table 17**).
- **Data and settings** - view data items for the selected menu (see **Table 17**).
- **Current status messages** - check the most recent UPS event and alarm messages (see **Table 41** in **Appendix B**).
- **Navigation key icons** - look at the icon above each navigation key to determine how the key operates when pressed (see **6.6 - Navigation Keys**).

The LCD displays alarm information in real time. After appearing in the current status section of the LCD, status messages are stored in the history log—512 records can be stored and retrieved.

Figure 32 Sections of the LCD



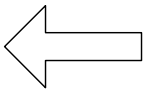
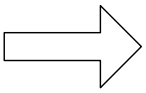
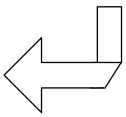
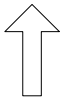
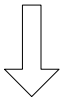
6.6 Navigation Keys

The navigation keys on the front panel—F1 through F4 and Help—are used to access the LCD to view the current status and other information about the Liebert *e*XM.

Navigation key icons on the LCD appear above each key to indicate its operation (see **Table 16**). The keys are "soft keys" that can change functions according to the icon.

- Use **F1** to move to the home portion of the LCD.
- Use **F3** and **F4** as cursor keys to move left and right or up and down, depending on the icons displayed above the keys.
- Use **F3** and **F4** on the display simultaneously to view individual Module information such as Input and Output conditions and individual Module Firmware versions
- Use **F2** as an ESC key.
- Use **HELP** to access help information on the LCD or to enter a choice.

Table 16 Icons for navigation keys

Key	F1	F2	F3	F4	HELP
Functions Available	Home	ESC Exit	 Left	 Right	 Enter
			 Up	 Down	Help

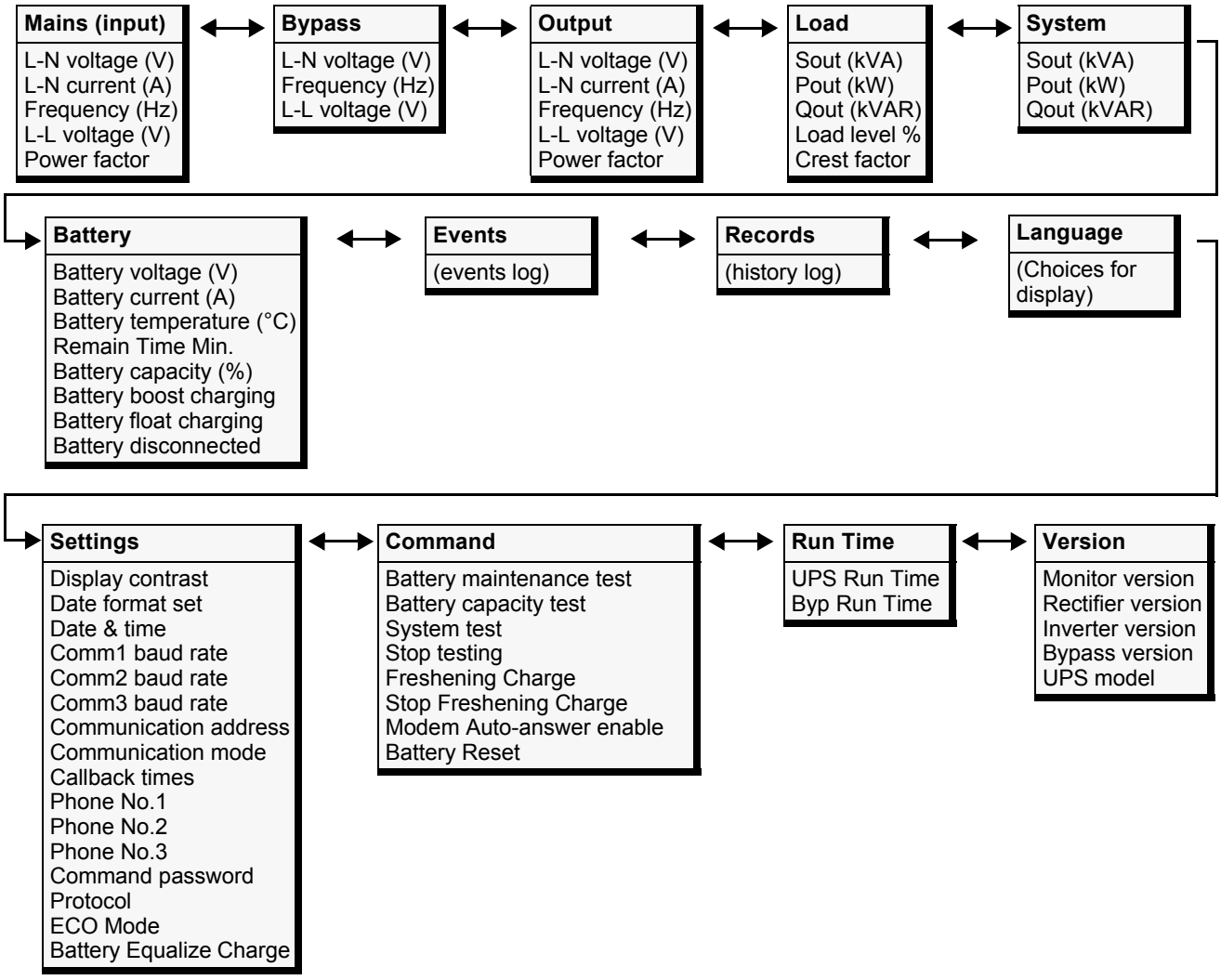
6.7 LCD Menus and Data Items

The LCD menus provide access to the following categories of information and settings for the UPS. Selecting a menu changes the information displayed in the UPS data items portion of the LCD. The menu choices are listed below and described in detail in **Table 17**.

- **Mains**—View utility power input data: voltage, current, frequency and power factor
- **Bypass**—View bypass data: voltage and frequency
- **Output**—View output data: voltage, current, frequency and power factor
- **Load**—View load data: load percent, output current, output power and crest factor (CF)
- **System**—View system data
- **Battery**—View battery characteristics - voltage, current, temperature, remaining time and capacity - and messages when the battery is boost/float charging or disconnected
- **Events**—View the events log—displays all recent events added to the log (new records added at end)
- **Records**—Access the history log—displays all records in the log (new records added at end)
- **Language**—Select a language for LCD text (choices appear in the native language)
- **Settings**—Configure UPS settings: adjust the display contrast, choose a format for date display, set the date and time, set up the UPS for modem communications (baud rate, address, mode and phone numbers to dial for alarm notifications) and change the password
- **Command**—Start or stop a battery maintenance test, battery capacity test or system test
- **Run Time**—View available backup time for the UPS and bypass
- **Version**—View firmware versions for the inverter, rectifier and software display board and the model information for the UPS

Figure 33 shows a menu tree of the options available from the LCD menus.

Figure 33 Menu tree



6.8 Language Selection

The LCD menus and data display are available in 12 languages (Chinese, Dutch, English, French, German, Italian, Japanese, Polish, Portuguese, Russian, Spanish and Swedish). To select a different language:

1. From the main menu, press the **F4** (shift) key to move the cursor to the **Language** menu at the bottom of the screen.
2. Press **HELP** to access the language choices.
3. Press **F3** and **F4** (left and right arrows) as needed to highlight the desired language.
4. Use **HELP** to select the required language.
5. Return to the main menu by repeatedly pressing **F2** (ESC) and **F1**.
   All text on the LCD will now be displayed in the selected language.

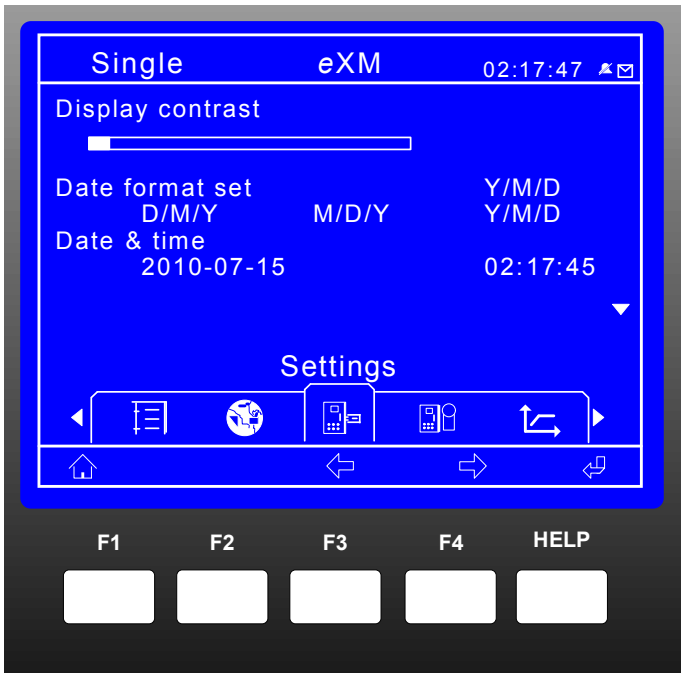
Figure 34 Language selection screen

6.9 Current Date and Time

To change the system date and time:

1. From the main menu, press the **F4** (shift) key to move the cursor to the **Settings** menu at the bottom of the screen.
2. Press **HELP** to select the **Settings** menu.
3. Use **F3** and **F4** (up and down) to select the **Date & Time** option, then press **HELP** (enter).
4. Use **F4** to position the cursor on the row where the date and time are displayed, then press **HELP** (enter).
5. Using the **F3** (up), enter the current time and date information.
6. Press **HELP** (enter) to save the settings.
7. Press **F2** (ESC), then **F1** to return to the main screen.

Figure 35 Date and time screen

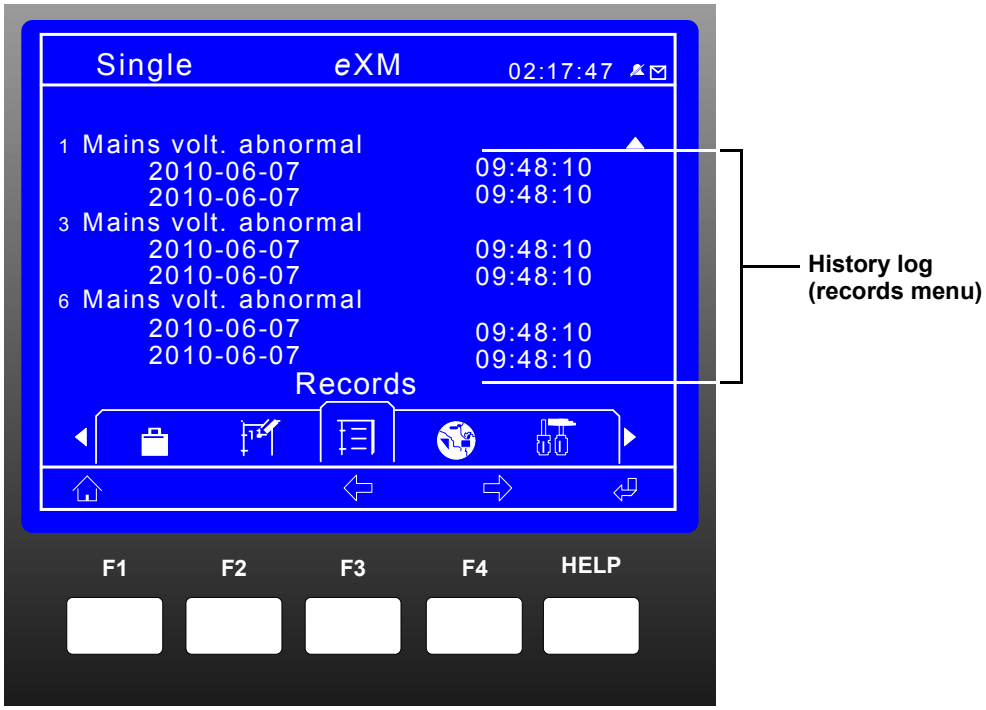


6.10 UPS History Log

The Liebert *e*XM displays status changes as they occur and stores that data in the **history log**, as shown in **Figure 36**.

- **History Log:** When a record moves to the history log, the time the status changed is recorded. The history log can hold up to 512 records. History log records may be viewed by accessing the Records menu.

Figure 36 History log records



See **Table 41** in **Appendix B** for a complete list of status messages, along with a description and any recommended actions.

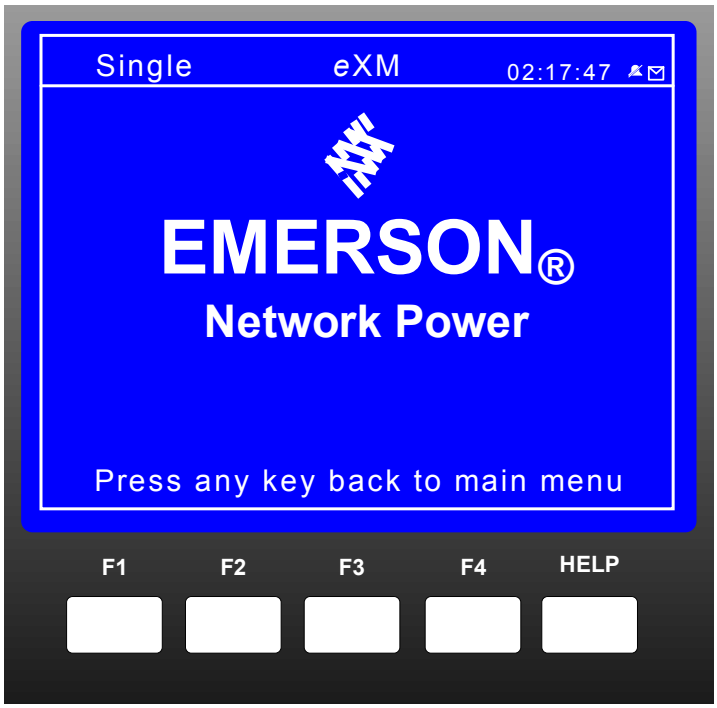
6.11 Types of LCD Screens

This section provides a quick guide to the main types of LCD screens.

6.11.1 Opening Display

As the UPS begins powering up, the opening display appears, as shown in **Figure 37**.

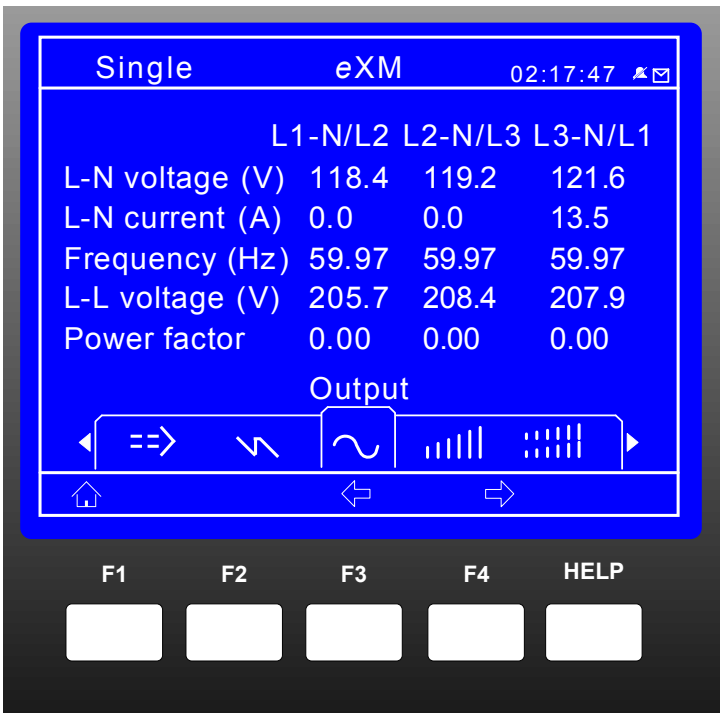
Figure 37 Opening display



6.11.2 Default Screen

After the UPS has powered up and completed a self-test, the output screen appears, as shown in **Figure 38**. This window is the default screen.

Figure 38 Default screen



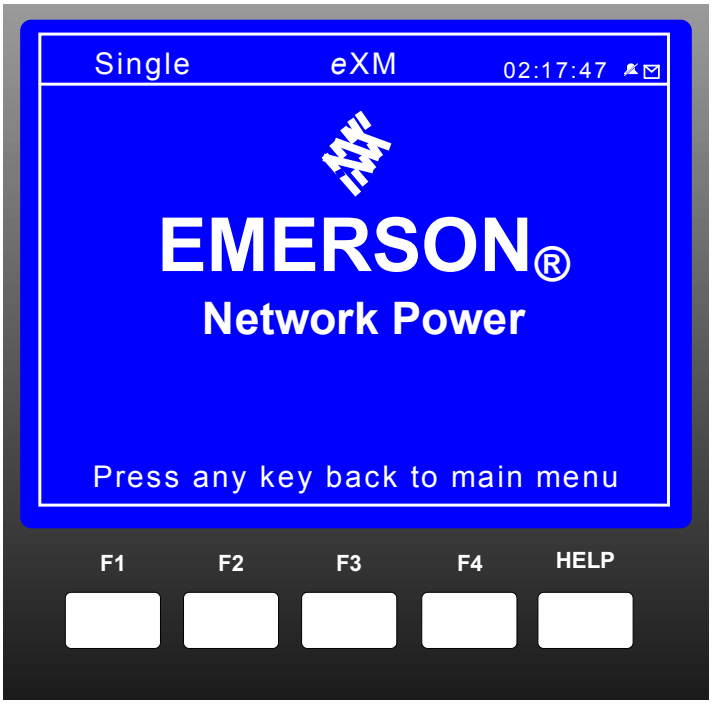
6.11.3 UPS Help Screen

Press the HELP key below the LCD to display the Help window. (Press the HELP key again to exit the Help window.)

6.11.4 Screen Saver Window

If there has been no interaction with the Liebert *e*XM's LCD for 2 minutes, the screen saver window appears. It remains on the LCD for 2 minutes, then the screen will go dark. The LCD will become active again when any key is pressed.

Figure 39 Screen saver window



6.12 Pop-Up Windows

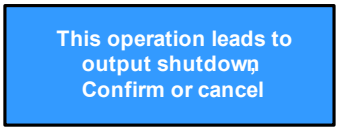
Pop-up prompt windows appear when the user must confirm a choice or perform an operation. This section describes the pop-up windows. Some operations require entering a password; refer to **6.12.9 - Enter Control Password** for help.

6.12.1 From Bypass to Inverter Mode With Power Interruption

If the bypass voltage or frequency exceeds the synchronized range and utility voltage or frequency is normal, the inverter cannot be in synchronization with the bypass, and the output can only transfer to inverter after an interruption of about 15ms when the user presses the INVERTER ON button. Before transferring, the system will let the user confirm whether the interruption can be accepted, as shown at right. If the bypass voltage returns to normal before the user makes confirmation, the UPS will transfer to inverter mode automatically. At the same time, the prompt window will close.

6.12.2 From Inverter to Bypass Mode With Interruption

If the bypass voltage or frequency exceeds the synchronized range and the UPS is in inverter mode, the system must let the user confirm and accept the power interruption danger before pressing the INVERTER OFF button to shut down the output of the inverter. The user can also cancel the shutdown operation, as shown at right. If the bypass voltage returns to normal before the user makes the confirmation, the UPS will transfer to bypass operation mode automatically, and at the same time the prompt window will disappear soon.



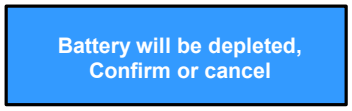
6.12.3 System Self-Test

When a system self-test is completed, a pop-up window reports the results of the test, as shown at right.

- Press the **Help** (Enter) key and the pop-up window closes.

6.12.4 Battery Capacity Test Confirmation

When a battery capacity test is started from the Command menu, the battery will be discharged to low-battery warning level. The Liebert *e*XM asks for confirmation before the test is started, as shown at right.



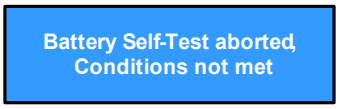
- To confirm the choice and begin the battery capacity test, press the **Help** (Enter) key and the pop-up window disappears.
- To cancel the test, press the **F2** (ESC) key. The pop-up window disappears.

NOTE

For a battery capacity test to function properly, the load must be between 20% and 100%.

6.12.5 Battery Self-Test Aborted, Condition Not Met

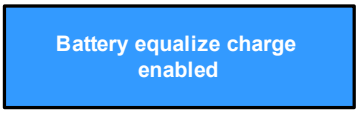
When a battery capacity test is started from the Command menu and the battery self-test condition is inadequate, the Liebert *e*XM will not perform a battery test. User should check whether the battery state is boost charging and whether the load level is greater than 20 percent.

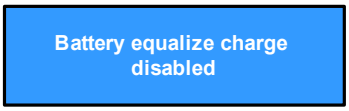


- Press the **Help** (Enter) key and the pop-up window closes.

6.12.6 Battery Equalize Charge

The user can Enable or Disable the Battery Equalize Charge of the batteries. Use the F3 or F4 button to Enable or Disable the Battery Equalize feature.

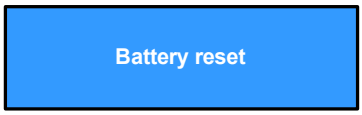




- Press the **Help** (Enter) key and the pop-up window closes.

6.12.7 Battery Reset

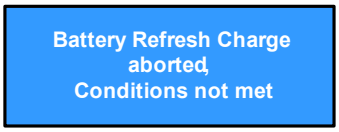
The user can reset the battery statistics to a new battery state. Use the F3 or F4 button to select Battery Reset



- Press the **Help** (Enter) key and the pop-up window closes.

6.12.8 Battery Refresh Charge Aborted, Condition Not Met

When a battery refreshening charge is started from the Command menu and battery refreshening condition fails to meet requirements, the Liebert *e*XM will not perform a battery refreshening charge. User should check if boost charging condition is not enough, such as (No battery, charger failed, etc.).



- Press the **Help** (Enter) key and the pop-up window closes.

6.12.9 Enter Control Password

When a UPS control operation requires a password, the pop-up at right will be displayed. The password is 12345.

Use the Right or Left arrow to move the cursor along the password field. Then use the Up and Down arrows to advance until the desired number is displayed. Enter the password one digit at a time.

Table 17 UPS menus and data window items

Menu Type	Item Type	Explanation
Mains (input)	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Input frequency
	L-L voltage (V)	Line-line voltage
	Power factor	Power factor
Bypass	L-N voltage (V)	Phase voltage
	Frequency (Hz)	Bypass frequency
	L-L voltage (A)	Line-line voltage
Output	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Output frequency
	L-L voltage (V)	Line-line voltage
	Power factor	Power factor
Load	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
	Loadlevel %	The percent of the UPS rating load
	Crest factor	Output current Crest Factor
System	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
	Single unit	When configured as a single unit, UPS displays only native load, no system load.
Battery	Battery voltage (V)	Battery bus voltage
	Battery current (A)	Battery bus current
	Battery temperature (°C)	Internal battery temperature °C
	Remain Time Min.	Battery run time remaining
	Battery boost charging	Battery is boost charging
	Battery float charging	Battery is float charging
	Battery equalize charging	Battery charge is equalized
	Battery disconnected	Battery is not connected
Events	(event log)	Displays recent events
Records	(history log)	Displays all records in the history log
Language	(choices for text displayed)	User may select any of 12 languages for LCD text.

Table 17 UPS menus and data window items *(continued)*

Menu Type	Item Type	Explanation
Settings	Display contrast	Adjust the LCD display contrast
	Date format set	Choose the format for date display: YYYY MM DD, DD MM YYYY and MM DD YYYY
	Date & time	Set the date and time
	Comm1 baud rate	Communication baud rate setting for Liebert IntelliSlot 1
	Comm2 baud rate	Communication baud rate setting for Liebert IntelliSlot 2
	Comm3 baud rate	Communication baud rate setting for Liebert IntelliSlot 3
	Communication address	This setting is applicable to RS485 communication mode
	Communication mode	Communication Mode Setting
	Callback times	When Liebert IntelliSlot 1 Communication mode is Modem, this parameter sets the number of times a number is redialed to send an alarm notification.
	Phone No.1	When Liebert IntelliSlot 1 Communication mode is Modem, this is the first phone number to be dialed (to send an alarm notification).
	Phone No.2	When Liebert IntelliSlot 1 Communication mode is Modem, this is the second phone number to be dialed (to send an alarm notification).
	Phone No.3	When Liebert IntelliSlot 1 Communication mode is Modem, this is the third phone number to be dialed (to send an alarm notification).
	Command password	User can modify the command password.
	Protocol	System protocol
	ECO Mode	Configures UPS for ECO mode
	Battery Equalize Charge	Configures UPS for equalize charge
Command (Start/Stop Battery & System Tests)	Battery maintenance test	This test performs a partial discharge of the battery to obtain a rough estimate of the battery capacity. Load must be between 20% and 80%.
	Battery capacity test	This test performs a full discharge of the battery to obtain a precise measure of the battery capacity. Load must be between 20% and 80%.
	System test	This is a self-test of the UPS. When the user activates this function, a pop-up window appears about 5 seconds later to show the results.
	Stop testing	Manually stops a battery maintenance test, battery capacity test or system test.
	Freshening Charge	Allows a temporary Equalize charge for the batteries. This charge is configurable for 1 to 36 hours.
	Stop Freshening Charge	Manually stops a Freshening Charge.
	Modem Auto-answer enabled	Manually enable the modem's auto-answer function.
	Battery Reset	Resets battery statistics
Run Time	UPS Run Time	UPS Run Time
	Byp Run Time	Bypass Run Time
Version	UPS model	Provides UPS model information—for example, 208V-60Hz.
	Monitor Version	Monitor Firmware Version
	Rectifier Version	Rectifier Firmware Version
	Inverter Version	Inverter Firmware Version
	Bypass Version	Bypass Firmware Version

7.0 OPERATION

WARNING

Risk of electrical shock. Can cause personal injury or death. This UPS has several circuits that are energized with high DC as well as AC voltages. Check for voltage with both AC and DC voltmeters before working within the UPS. Check for voltage with both AC and DC voltmeters before making contact.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should be involved in installing the UPS or preparing the UPS for installation. When performing maintenance with any part of the equipment under power, service personnel and test equipment should be standing on rubber mats.

AVERTISSMENT

Risque de décharge électrique pouvant causer des blessures graves, voire mortelles. Ce système ASC comporte plusieurs circuits à haute tension c.a et c.c. Vérifiez les tensions au moyen de voltmètres c.a. et c.c. avant d'utiliser le système ASC. Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact.

Seuls des employés qualifiés et dûment formés portant un casque, des gants, des chaussures et des lunettes de sécurité adéquats doivent se charger d'installer le système ASC ou de le préparer pour l'installation. Les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc lors de toute intervention sur une pièce d'équipement sous tension.

The Liebert eXM operates in the modes shown in **Figure 7.1 - Liebert eXM Operating Modes**. This section describes various kinds of operating procedures under each operating mode, including transfer between operating modes, UPS setting and procedures for turning on/off inverter. As shown in SL-25651, the Liebert *e*XM Battery Cabinet manual, the AC utility source is supplied through the input breaker, and the rectifier converts the alternating current into DC power. The inverter converts the AC power from the utility—or DC power from an optional External Battery Cabinet—into AC power for the load. The batteries power the load through the inverter in the event of a power failure. The utility source can also power the load through the static bypass. If maintenance or repair of the UPS is necessary, the load can be switched without interruption in service using the optional Liebert MBC.

7.1 Liebert *e*XM Operating Modes

The UPS is designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:

- Normal Mode
- Battery Mode
- Auto-Restart Mode
- ECO Mode
- Bypass Mode
- Battery Start Mode
- Maintenance Mode (Manual Bypass)
- Sleep Mode
- Paralleling Mode
- Output Voltage Adjustment
- Generator Mode

NOTE

1. *The user controls and indicators mentioned in these procedures are identified in **6.0 - Operator Control and Display Panel**.*
2. *The audible alarm may sound at various points during these procedures. It can be canceled at any time by pressing the SILENCE ON/OFF push button.*

NOTE

This unit refers to some modes and conditions that are set or adjusted using proprietary service software. To take advantage of all the available features for the Liebert e*XM, the unit must be commissioned by an Emerson-authorized engineer.*

Normal Mode

Operating in normal mode, the Liebert *e*XM's rectifier derives power from a utility AC source and supplies regulated DC power to the inverter, which regenerates precise AC power to supply the connected equipment. The rectifier also uses the utility source power to charge the batteries.

Battery Mode—Requires Optional External Battery Cabinet

When utility AC power fails, the Liebert *e*XM protects the critical load by instantaneously channeling battery power from optional External Battery Cabinets to the inverter, which continues supporting the critical load without interruption. When utility power returns and is within acceptable limits, the Liebert *e*XM automatically shifts back to Normal mode, with the rectifier powering the critical load.

Auto-Restart Mode

The battery may become exhausted following an extended AC utility failure. The inverter shuts down when the battery reaches the End of Discharge voltage (EOD). The UPS may be programmed to "Auto Recovery after EOD" after a delay time if the AC utility recovers. This mode and any delay time may be programmed by the commissioning engineer.

Bypass Mode

When the Liebert *e*XM is in bypass mode, the load is directly supported by utility power and is without battery backup protection.

The Liebert *e*XM's static transfer switch will shift the load from the inverter to bypass mode without interruption in AC power if the inverter is synchronous with the bypass and any of the following occurs:

- inverter fails
- inverter overload capacity is exceeded
- inverter is manually turned off by user

NOTE

If the inverter is asynchronous with the bypass, the static switch will transfer the load from the inverter to the bypass WITH interruption in AC power to the critical load. This interruption will be less than 15ms (in 50Hz), or less than 13.33ms (in 60Hz). This interruption time may be altered by modifying the Output transfer interrupt time setting.

ECO Mode (Single-Module UPS System Only)

When ECO mode is selected, the Liebert *e*XM switches inverter power from the UPS input to the bypass input to save energy by improving UPS efficiency. In this mode, the bypass is the preferred source. If the bypass voltage or frequency becomes outside preset limits, the UPS load is transferred back to the inverter.

Battery Start Mode

The battery start option permits starting the Liebert *e*XM with power supplied only by the batteries (at charged condition).

Maintenance Mode

For maintenance or repair, the Liebert *e*XM may be operated in maintenance mode. To place the Liebert *e*XM in maintenance mode, follow the instructions in **7.4 - Switching the UPS from Normal Operation to Maintenance Bypass**.

WARNING

Risk of arc flash and electric shock. Can cause equipment damage, injury and death

The UPS input and output must be protected with external overcurrent protection devices. In maintenance mode, the input and output busbars remain energized and present an electric shock hazard.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

L'entrée et la sortie du système ASC doivent être protégées par des dispositifs de protection de surintensité externes. En mode d'entretien, les barres omnibus d'entrée et de sortie demeurent sous tension et présentent un risque de décharge électrique.

Paralleling Mode

This option is available only on 208V Input Parallel with the optional Liebert *e*XM Paralleling Cabinet. It can parallel the following:

- two Liebert *e*XM's
- 120-200kW frames in any module capacity
- redundant
- can allow up to 400kW of load capacity
- paralleling configurations: 1+1 is 120-200kVA; 2+0 is 120-160kVA; 2+1 is 120-160kVA

A sharing inductor and optional Liebert *e*XM Paralleling Cabinet are required for parallel units.

NOTE

To parallel non-208 input voltages, an upstream transformer must drop the input voltage to 208V before the paralleling gear.

Output Voltage Adjustment

This feature allows a Liebert Customer Engineer to adjust the Liebert *e*XM's output voltage over a range of -5% to +5% of nominal. The output voltage adjustment can be used to compensate for any drop in line voltage that may occur when the UPS is a significant distance from the protected load. In addition, it can be used to optimize the UPS output voltage for loads that operate more efficiently at a voltage different from the nominal Liebert *e*XM output voltage.

Generator Mode

The Liebert *e*XM UPS can be set up for operation in Generator Mode by an Emerson Network Power Liebert Services engineer. The setup requires connecting J26 Pin 2 to Pin 4.

7.2 UPS Startup

The Liebert *e*XM must be fully installed and commissioned before startup, and external power isolators must be closed. Once those general conditions are met, the UPS may be started.

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

During this procedure the output terminals will become live.

If any load equipment is connected to the UPS output terminals, please check with the load user and ascertain whether it is safe to apply power to the load. If the load is not ready to receive power, then ensure that it is safely isolated from the UPS output terminals.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

Durant cette procédure, les bornes de sortie seront sous tension.

Si un équipement chargé est raccordé aux bornes de sortie du système ASC, veuillez vous informer auprès de l'utilisateur de la charge s'il est sécuritaire d'appliquer une alimentation à la charge. Si la charge n'est pas prête à recevoir une alimentation, alors assurez-vous qu'elle est isolée sécuritairement des bornes de sortie du système ASC.

7.2.1 Startup Procedure

To start the UPS from a fully powered-down condition:

1. Open the external power switch.
2. Open the UPS door.
3. Connect the power supply cables.
4. Ensure the correct phase rotation.
5. Close the external input circuit breaker and connect input power.

   The LCD activates. The rectifier indicator flashes while the rectifier is starting. The rectifier enters normal operation state, and after about 30 seconds, the rectifier indicator stops blinking and is illuminated in a steady green. After initialization, the bypass static switch turns on. The mimic LEDs appear as shown **Table 18**.

Table 18 Mimic indicators after initialization

LED	Status
Rectifier Indicator	Green
Battery Indicator	Red
Bypass Indicator	Green
Inverter Indicator	Off
Load Indicator	Green
Status Indicator	Amber

6. Ensure that the Liebert power module assembly ready switches are latched (in Down position).
7. Close the external output circuit breaker.
8. Press the INVERTER ON button for 2 seconds. The inverter indicator flashes while the inverter is starting. After the inverter is ready, the UPS transfers from bypass to inverter, the bypass indicator turns Off, and the inverter indicator turns On. The UPS is in Normal Mode. The mimic LEDs will appear as shown in **Table 19**.

Table 19 Mimic indicators for normal mode operation with battery breaker open

LED	Status
Rectifier Indicator	Green
Battery Indicator	Red
Bypass Indicator	Off
Inverter Indicator	Green
Load Indicator	Green
Status Indicator	Amber

9. Close the battery breaker.

Table 20 Mimic indicators for normal mode operation with battery breaker closed

LED	Status
Rectifier Indicator	Green
Battery Indicator	Off
Bypass Indicator	Off
Inverter Indicator	Green
Load Indicator	Green
Status Indicator	Green

7.2.2 Startup in ECO Mode

ECO Mode is available only on a single-module Liebert *e*XM.

1. Verify that input power is available.
2. Select ECO Mode on the Control Panel.
3. Verify that the bypass indicator remains green to indicate that the load is supplied by the bypass input. The inverter indicator will flash green to indicate that the inverter is on standby in ECO Mode.

The UPS is now operating in ECO Mode.

7.2.3 Switching Between UPS Operation Modes

To switch from Normal Mode to Static Bypass Mode—Press the INVERTER OFF button to switch to Bypass Mode (see **Figure 30**).

NOTE
In Static Bypass Mode, the load is being powered by the utility and is not protected from fluctuations in input power: spikes, sags and failure.

To Switch From Bypass Mode To Normal mode—When the UPS is in Bypass Mode, press the INVERTER ON button. After the inverter enters normal operation, the UPS transfers to Normal Mode.

To switch from Normal Mode to ECO Mode—Select ECO Mode using the Liebert *e*XM control panel. After a 5-minute qualification of the bypass voltage, the UPS will transfer to bypass.

The Bypass indicator on the MIMIC display will illuminate Green to indicate that the UPS is operating properly with input power form the bypass input. The Inverter indicator will flash Green to indicate that the Inverter is on standby in ECO mode.

NOTE
In ECO Mode, the load is being powered by the utility as long as the bypass source remains within set limits.

To switch from ECO Mode to Normal Mode—When the UPS is in ECO Mode, press the INVERTER ON button. After the inverter enters normal operation, the UPS transfers to Normal Mode.

7.3 UPS Battery Start

The Battery Start option permits starting the Liebert *e*XM with power supplied only by the batteries (at charged condition).

NOTICE

Risk of loss of power to the connected load. Can cause equipment damage.

Before attempting to start the UPS without utility power present, ensure that the batteries are fully charged—over 2.1V per cell—and will supply adequate run time to the load. Load requirements may deplete batteries that are not fully charged an may cause an unintended UPS shutdown.

1. Verify that the battery cabinet is properly connected (see **Figure 24**) and that the battery breaker is closed.
2. Press the Battery Start button on the front panel of any Liebert power module assembly for 2 seconds.

   The LCD displays the start screen, and the battery indicator flashes green. It stops flashing and becomes solid green about 30 seconds after the rectifiers enter normal operation.
3. Press and hold the INVERTER ON key for two seconds, and the UPS will begin operating in battery mode.

7.4 Switching the UPS from Normal Operation to Maintenance Bypass

Follow the procedure below to transfer the load from the UPS inverter output to the Maintenance Bypass system.

NOTICE

Risk of loss of power to the connected load.

Can cause equipment damage.

This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. Failure to follow these instructions will result in loss of power and possible damage to critical equipment.

Before performing this operation, read any messages on the LCD to be sure that bypass supply is regular and the inverter is synchronous with it. If those conditions are not present, there is a risk of a short interruption in powering the load.

This procedure assumes that UPS is operating normally.

1. Press the INVERTER OFF button on the right side of the Operator Control Panel for longer than 2 seconds.

   The Inverter indicator will turn Off, the status indicator will turn amber and an audible alarm will sound. The load will transfer to static bypass (internal) and the inverter will shut off.

NOTE

Pressing the Alarm Silence Switch cancels the audible alarm, but leaves the warning message displayed until the appropriate condition is rectified.

2. Open the Liebert MBC door to gain access to the bypass isolation breaker (BIB), maintenance bypass breaker (MBB) and maintenance isolation breaker (MIB).
3. When the lamp indicator on the MBC is illuminated, press and hold the adjacent push button and remove the Key from the lock (K0).
4. Insert the Key into the lock on the MBB and turn the Key.
5. Close the MBB.
6. Verify the MBB is closed. Failure to close the MBB will interrupt power to the load.
7. Open the MIB.
8. Remove the key from the lock on the MIB. Insert the key into the lock (K0) and turn the key.
9. The UPS system is now isolated from the critical load.
10. For a single-input system, the bypass isolation breaker (BIB) remains closed; this allows power to remain present at the UPS input; refer to **Figure 40**.
11. For a single-source, dual-input system, the bypass isolation breaker (BIB) can be opened to further isolate the UPS from input power; refer to **Figure 41**.

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Wait 5 minutes for the internal DC busbar capacitors to discharge before attempting to remove the internal protective barriers.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

Attendez 5 minutes que les condensateurs de barre omnibus c.c. internes se déchargent avant d'essayer de retirer les barrières de protection internes.

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Even with the UPS in maintenance bypass and Off, portions of the Liebert *e*XM system are still energized. Service must be performed by properly trained and qualified personnel only.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

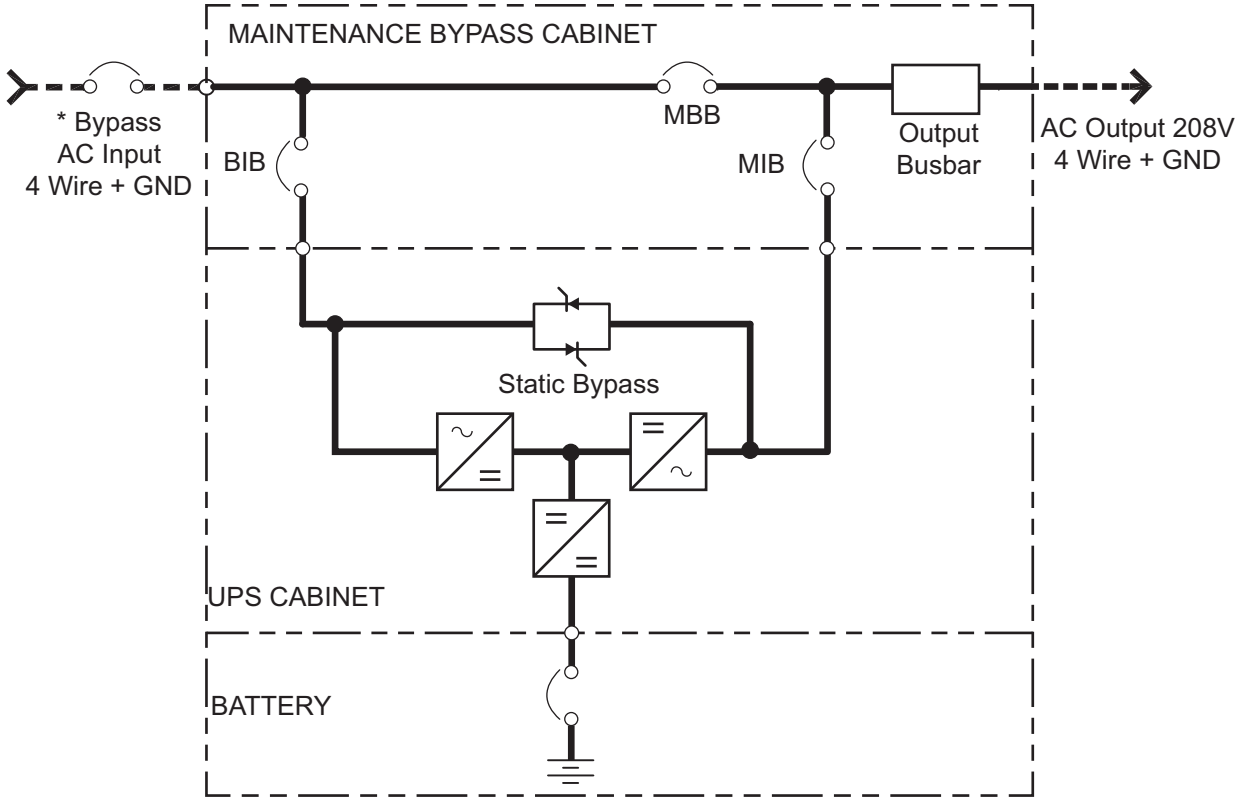
Même lorsque le système ASC est en mode de dérivation d'entretien et hors tension, des parties du système eXM de Liebert demeurent sous tension. L'entretien ne doit être confié qu'à un personnel qualifié et dûment formé.

NOTICE

Risk of power loss to connected load. Can cause damage to equipment.

The load equipment is not protected from normal supply aberrations when the Liebert *e*XM is operating in the maintenance bypass mode.

Figure 40 One-line diagram, single-input UPS with 3-breaker maintenance bypass cabinet and panelboard



Notes
1. Install in accordance with national and local electrical codes.
2. Input and bypass must share the same single source.
3. A neutral is required from the sytem AC input source. Emerson recommends a full capacity neutral and grounding conductors.
4. Bypass and rectifier input and output cables must be run in separate conduits
5. Control wiring must be run in separate conduits.

BIB - Bypass Isolation Breaker
MBB - Maintenance Bypass Breaker
MIB - Maintenance Isolation Breaker
* External Overcurrent Protection By Others
▬▬ Field-Supplied Wiring

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7.5 Switching the UPS from Maintenance Bypass to Normal Operation

Follow the procedure below to transfer the load from the Maintenance Bypass system to the UPS inverter output.

These conditions must be met for this operation to proceed:

- the UPS must be operating normally
- the BIB breaker must be closed
- the UPS system must be in the Maintenance Bypass mode of operation.

NOTICE

Risk of loss of power to the connected load.

Can cause equipment damage.

This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. Failure to follow these instructions will result in loss of power and possible damage to critical equipment.

Before performing this operation, read any messages on the LCD to be sure that bypass supply is regular and the inverter is synchronous with it. If those conditions are not present, there is a risk of a short interruption in powering the load.

1. Verify that the Liebert *e*XM is in Maintenance Bypass mode.

NOTE

Pressing the Alarm Silence Switch cancels the audible alarm, but leaves the warning message displayed until the appropriate condition is rectified.

2. Open the Liebert MBC door to gain access to the bypass isolation breaker (BIB), maintenance bypass breaker (MBB) and the maintenance isolation breaker (MIB).
3. When the Lamp indicator on the MBC is illuminated, press and hold the adjacent push button and remove the key from the lock (K0).
4. Insert the key into the lock on the MIB, and turn the key.
5. Close the MIB.
6. Verify the MIB is closed. Failure to close the MIB will interrupt power to the load.
7. Open MBB.
8. Remove the key from the lock on the MBB.
9. Insert the key into the lock (K0) and turn the key.

   The UPS system is now supplying power to the critical load.
10. Press the INVERTER ON button on the right side of the Operator Control Panel for longer than 2 seconds.

    The Inverter indicator flashes while the inverter is starting.

    After the inverter is ready, the UPS transfers from static bypass to inverter, the bypass indicator turns Off and the inverter indicator turns On. The UPS is in Normal Mode. The indicator will appear as shown in **Table 20**.

7.6 De-Energize Liebert *e*XM with Maintenance Bypass Cabinet

NOTICE

Risk of loss of power to the connected load. Can cause equipment damage.

This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. This procedure will remove power from the critical bus.

Take precautions by providing a backup power supply or shutting down equipment before de-energizing the Liebert *e*XM.

To de-energize the system:

1. On the UPS control panel, press and hold the INVERTER OFF button for 2 seconds.
2. Open all battery circuit breakers(s) including the internal battery breaker (if applicable).
3. If the MBC is an Emerson cabinet, open the Maintenance Isolation Circuit Breaker (MIB). If the MBC is a customer-issued switchgear or a non-Emerson cabinet, open the breaker(s) that supply power to the critical bus.
4. Open the Rectifier Input Circuit Breaker and Bypass Input Breaker (if dual input). If the MBC is a customer-issued switchgear or a non-Emerson cabinet, open the breaker(s) that supply power to the UPS input and bypass input (if dual input).
5. Allow 5 minutes for all DC circuits and capacitors to fully discharge.
6. Open the external feeder breaker to the MBC or bypass switchgear.
7. Install a Lockout/Tagout on the external feeder breaker to the MBC or bypass switchgear.
8. Use a digital multimeter to verify there is no AC or DC voltage present at the UPS input, output and bypass bus bars.
9. Use a digital multimeter to verify there is no AC or DC voltage present at the MBC BIB, MIB and MBB breakers.

7.7 De-Energize Liebert *e*XM Without Maintenance Bypass Cabinet

NOTICE

Risk of loss of power to the connected load. Can cause equipment damage.

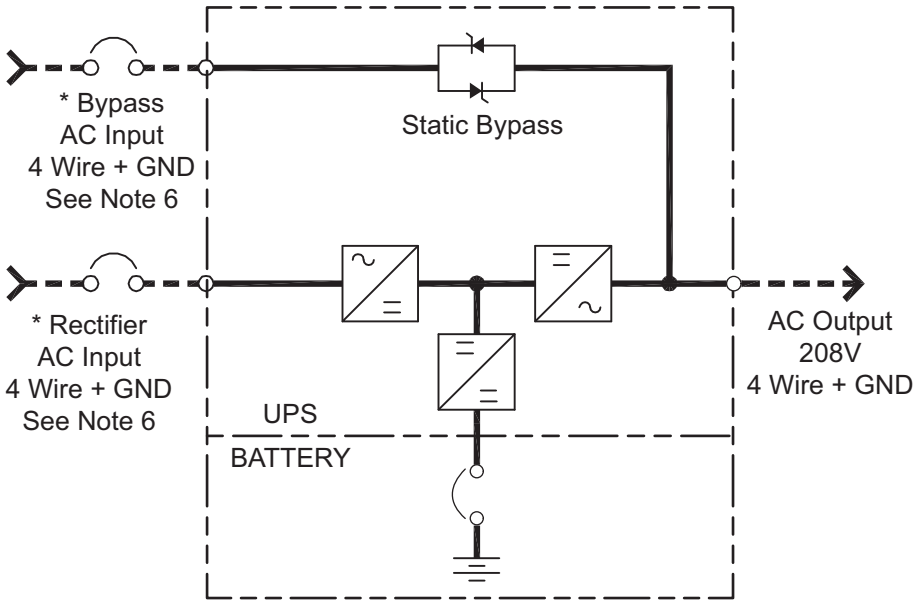
This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. This procedure will remove power from the critical bus.

Take precautions by providing a backup power supply or shutting down equipment before de-energizing the Liebert *e*XM.

To de-energize the Liebert *e*XM:

1. On the UPS control panel, press and hold the INVERTER OFF button for 2 seconds.
2. Open all battery circuit breakers(s) including the internal battery breaker (if applicable).
3. Open the UPS output circuit breaker(s).
4. Open the UPS input circuit breaker and bypass circuit breaker (dual input systems only).
5. Allow 5 minutes for all DC circuits and capacitors to fully discharge.
6. Use a digital multimeter to verify there is no AC or DC voltage present at the UPS input, output and bypass bus bars.

Figure 41 Typical configuration for single UPS



Notes:
1. Install in accordance with national and local electrical codes.
2. Input and bypass must share the same single source.
3. A neutral is required from the system AC input source. Emerson recommends a full-capacity neutral conductor and grounding conductors.
4. Bypass and rectifier inputs and output cables must be run in separate conduits.
5. Control wiring must be run in separate conduits.
6. Customer must supply shunt trip breakers with 120V coils to the bypass and rectifier inputs.

7.8 De-Energize a Liebert *e*XM Parallel System

To de-energize a parallel system:

1. On the control panel of UPS 1, press and hold INVERTER OFF for until inverter and output LEDs turn off.The output LED will turn back on until **Step 2**.
2. On the control panel of UPS 2, press and hold INVERTER OFF for 2 seconds.
   If the system is 1+1 or 2+0, both units go to bypass.
   If the system is 2+1, the inverter LED and output LED will turn Off.
3. If applicable, on the control panel of UPS 3, press and hold INVERTER OFF for 2 seconds.
   a. All UPS's in the system will go to bypass.
4. Open all battery circuit breakers, if applicable.
5. Check the parallel switchgear.

NOTICE

Risk of loss of power to the connected load. Can cause equipment damage.

The following procedure will remove power from the critical bus. Before beginning these steps, shut down the connected load or transfer the connected load to an input power supply not dependent on the Liebert *e*XM system that is being de-energized.

   a. If the parallel switchgear is a matching Emerson cabinet, open the Maintenance Isolation Circuit Breaker (MIB).
   b. Open all Module Output Breakers (MOB).
6. Open the input breaker for each UPS and the breaker feeding the Maintenance Bypass Breaker (MBB) in the parallel switch gear.

The system is now de-energized, and its output power supply is Off.

7.9 Re-Energize a De-Energized Liebert *e*XM Parallel System

To re-energize a parallel system:

1. Close the input breakers for all UPS's
2. The LCD on each UPS will turn On and the rectifier LED will begin flashing green, starting the rectifier.
   The static switch LED and output LED will illuminate green.
   The battery LED will illuminate red.
3. Verify that the rectifier, static switch and output LEDs are illuminated green and not flashing.
4. Close the Module Output Breakers (MOB) circuit breaker to each UPS.
5. Close the MIB circuit breaker.

WARNING

Risk of electric shock. Can cause equipment damage, injury and death.

The following procedure will supply power to the critical bus. Before beginning, notify all personnel that input power is being supplied to the circuits and verify that the connected load is prepared for input current.

6. Verify that the K0 light illuminates.
7. On the control panel of UPS #1, press and hold INVERTER ON until the Inverter LED begins flashing.
8. On the control panel of UPS #2, press and hold INVERTER ON until Inverter LED begins flashing.
9. If applicable, on the control panel of UPS #3, press and hold INVERTER ON until inverter LED begins flashing.
10. The load is now supported by the inverter.
11. Verify that the rectifier, inverter, and output LEDs are solid green.
12. Close all battery circuit breakers if applicable.

13. Verify that the battery LED turns Off.
14. Verify that all the power modules have green run lights; all LED's on the front display are green except for the battery LED which will be Off.
15. Check the LCD's on each UPS to verify that there are no alarms on any UPS.

7.10 De-Energize and Isolate a Single Liebert eXM in a Parallel System

NOTICE

Risk of loss of power to the connected load. Can cause equipment damage.

The following procedure will remove power from one UPS in the parallel system. Do not proceed if the other UPS's supplying the critical load cannot accommodate the additional load. If the UPS's remaining energized cannot supply the full critical load, the system will go into overload and may switch the load to bypass power, where it will not be protected from utility power failure.

1. Determine whether the parallel system is set up for capacity or redundancy.
2. Verify that the UPS's in the parallel system that will remain energized can support the connected load.
3. On the UPS to be de-energized, press and hold INVERTER OFF until the inverter and output LED's turn Off.

NOTE
The load LED will turn back on until ***Step 4****.*

4. Open the Module Output Breaker (MOB) associated with the isolated UPS.
5. Verify that the rectifier LED is the only solid green LED on the display.
6. Open all battery circuit breakers associated with the UPS, if applicable. The battery LED will turn red.
7. Open the input breaker feeding the associated UPS.
8. The UPS to be removed from the system is in the off state. You will see *parapowerCANCommAbnorm*. Alarm annunciate on the other UPS(s) because they lost communication with the isolated UPS.

7.11 Re-Energize a Single Liebert eXM in a Parallel System

WARNING

Risk of electric shock. Can cause equipment damage, injury and death.

The following procedure will supply power to the critical bus. Before beginning, notify all personnel that input power is being supplied to the circuits and verify that the connected load is prepared for input current.

1. Close the input breaker feeding the Liebert *e*XM to be re-energized.
2. The LCD on the isolated UPS will turn On and the rectifier LED will begin flashing green, starting the rectifier. The battery LED will turn RED.
3. On the parallel switchgear, close the Module Output Breaker (MOB) for the isolated UPS.
4. Verify that the output LED illuminates green and is not flashing.
5. On the control panel of the isolated UPS, press and hold INVERTER ON until the inverter LED starts flashing green.
6. Verify that the rectifier, inverter and output LED's are solid green.
7. Close all battery circuit breakers, if applicable.
8. Verify that the battery LED turns Off.
9. Verify that all the power modules have green run lights.
   All LED's on the front display are green except the battery LED, which will be Off.
10. Check the LCD's on each UPS to verify that there are no alarms on any UPS.

7.12 Place a Liebert eXM Parallel System in Maintenance Bypass (with SKRU Interlock)

NOTICE

Risk of loss of power to the connected load. Can cause equipment damage.

The UPS's will not be supporting the connected load. The load will not be protected from utility input power failure.

1. On the control panel of UPS #1, press and hold INVERTER OFF until inverter and output LEDs turn off.
2. On the control panel of UPS #2, press and hold INVERTER OFF until inverter and output LED's turn Off.

   If the system is 1+1 or 2+0, both units will transfer to bypass.

   If the system is 2+1, the inverter LED and output LED will turn Off.
3. If applicable, on the control panel of UPS #3, press and hold INVERTER OFF until the inverter and output LED's turn Off.

   All UPS's in the system will transfer to bypass.
4. Verify that the inverter LED turns Off and that the static switch and output LED's are solid green on each UPS.
5. Open all battery circuit breakers, if applicable.
6. Check the parallel switch gear

   Steps a through **d** are applicable only if the system has a Kirk key interlock. If the system does not have a Kirk key interlock, skip to **Step e**.

   a. Verify that the K0 light illuminates.
   b. Press and hold the interlock push button.
   c. While holding the push button, turn and release the key from the Kirk key interlock.
   d. Insert the key into the Maintenance Bypass Breaker (MBB) lock and turn to unlock the latch from the breaker.
   e. Close MBB.
   f. Open the Maintenance Isolation Breaker (MIB)
   g. **Steps h** and **i** are applicable only if the system has a Kirk key interlock. If the system does not have a Kirk key interlock, skip to **Step 7**.
   h. Turn the key, locking MIB in place, then remove key.
   i. Insert the key into K0 and turn it to lock the key in place.

      The critical load is now on external maintenance bypass.
7. Open all Module Output Breakers (MOB)
8. Open the input breakers that feed each UPS.
9. The UPS's are now Off, and the load is supplied by external maintenance bypass.

7.13 Place a Liebert eXM Parallel System Online from Maintenance Bypass (with SKRU Interlock)

1. Close the input breaker feeding all UPS's.

   The LCD on all the UPS's will turn On and the rectifier LED will begin flashing green, starting the rectifier. The battery LED will turn RED.
2. On the parallel switchgear, close the Module Output Breaker (MOB) for all the UPS's.

   Verify that the output LED turns solid green on all UPS's in the system.
3. This will energize the output of the UPS, and illuminate the interlock push button if the system has a Kirk key interlock.
4. Check the parallel switch gear.

   Steps a through **c** are applicable only if the system has a Kirk key interlock. If the system does not have a Kirk key interlock, skip to **Step e**.
   a. Press and hold the interlock push button.
   b. While holding, turn and release the key from K0.
   c. Insert the key into the Maintenance Isolation Breaker (MIB) lock and turn to unlock the latch from the breaker.
   d. Close the MIB.
   e. Open the Maintenance Bypass Breaker (MBB)
   f. **Steps g** and **h** are applicable only if the system has a kirk key interlock. If the system does not have a Kirk key interlock, skip to **Step 5**.
   g. Turn the key, locking MBB in place, and then remove the key.
   h. Insert the key into the K0 and turn to lock the key in place. The critical load is now powered by the UPS static switch.
5. On the control panel of UPS #1, press and hold INVERTER ON until the inverter LED starts flashing green.
6. On the control panel of UPS #2, press and hold INVERTER ON until the inverter LED starts flashing green.
7. If applicable, on the control panel of UPS #3, press and hold INVERTER ON until the inverter LED starts flashing green.
8. Verify that the rectifier, inverter and output LED's on each UPS in the system are solid green.
9. Close all battery circuit breakers, if applicable.
10. Verify that the battery LED on each UPS in the system turns Off.
11. Verify that all the power modules have green run lights.

    All LED's on the front display are green except the battery LED and static switch LED, which will be Off.
12. Check the LCD's on each UPS to verify that there are no alarms on any UPS.

The system is now online and supporting the load.

7.14 Emergency Shutdown With EPO

This circuit has been designed to switch Off the UPS in emergency conditions (e.g., fire, flood, etc.). The system will turn Off the rectifier, inverter and stop powering the load immediately (including the inverter and bypass), and the battery stops charging or discharging.

If the input utility is present, the UPS's controls will remain active; however, the output will be turned Off. To remove all power from the UPS, the external feeder breaker should be opened. (Refer to **Figure 28**).

7.15 Auto Restart

When the main and bypass sources fail, the UPS draws power from the battery system to supply the load until the batteries are depleted. When the UPS reaches its end of discharge (EOD) threshold, it will shut down.

The UPS will automatically restart and enable output power:

- after utility power is restored
- if "Auto Recovery after EOD Enabling" is enabled in the UPS configuration (set by factory or by Liebert Services)
- after the "Auto Recovery after EOD Delay Time" expires (the default delay is 10 minutes)

  During the auto recovery delay, the Liebert *e*XM will be charging its batteries to provide a safety margin for equipment shutdown if input power fails again.

If the "Auto Recovery after EOD Enabling" feature is disabled, the system must be restarted manually.

7.16 Reset After Shutdown for Emergency Stop (EPO Action) or Other Conditions

Once all appropriate measures have been taken to correct the problem indicated by the alarm message appearing on the Operator Control Panel, carry out this procedure to restore the UPS to regular operation following an EPO action or for the following reasons: Inverter Overtemperature, Cut-Off Overload, Battery Overvoltage, excessive switching (BYP: XFER COUNT BLOCK), etc.

When the user confirms that the fault is cleared:

1. Press the FAULT CLEAR button to let the system exit the emergency off state.
2. Press the INVERTER ON button on the right side of the Operator Control Panel for longer than 2 seconds (after the rectifier has qualified).

NOTE

The rectifier will start automatically 5 minutes after the of overtemperature fault is cleared.

After the EPO button is pressed, if the input utility is removed, the UPS will shut down completely. When input utility is restored, the EPO condition will clear, and the UPS will enable the static bypass and restore the output.

7.17 Battery Protection

7.17.1 Battery Undervoltage Warning

Before the end of discharge, the Liebert *e*XM displays a low battery warning. After this warning, the battery has the capacity for 5 minutes discharging with full load (default time). The Liebert *e*XM can be user-configured to display this warning from 3 to 60 minutes before end-of-discharge.

7.17.2 Battery End-of-Discharge (EOD) Protection

If the battery voltage is lower than the end-of-discharge voltage, the battery converter will be shut down.

Table 21 Battery DC intermediate circuit

Parameter	120 - 200kVA
Battery Bus Voltage	288
Number of Lead-Acid Cells	144 = [24 x 6 cell (12V) blocks], nominal
Float Voltage	2.25V/cell, selectable from 2.2 - 2.3V/cell
Temperature Compensation	-3.0mV/°C, selectable from 0 to -5.0mV/°C around 77°F (25°C) or 86°F (30°C) or inhibit
Ripple Voltage	≤1%
Ripple Current	≤5%
Boost Charge Voltage	2.35 V/cell (selectable from 2.30-2.40V/cell)
Boost Control	• Float-boost current trigger 0.050 C10 (selectable 0.030-0.070) • Boost-float current trigger 0.010 C10 (selectable 0.005-0.025) 24 hr safety time-out (selectable 8-30 hr) Boost charge mode inhibit also selectable
End of Discharge	1.67 V/cell (selectable from 1.60-1.750V/cell)
Battery Charge	2.35 V/cell (selectable from 2.3-2.4V/cell) Constant current and constant voltage charge mode Programmable auto trigger or inhibit of boost mode
Battery Charging Power Maximum Current	UPS (kVA) 120, 140, 160, 180, 200 Battery Charging Power, kW: 18, 21, 24, 27, 30 Maximum Charging Current, A: 54, 63, 72, 81, 90

7.18 Operation

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

The Liebert *e*XM contains high voltages internally. Components that can only be accessed by opening the protective cover with tools cannot be serviced or replaced by the user.

Only properly trained and qualified service personnel are authorized to remove the protective covers.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

L'armoire Liebert eXM contient des tensions élevées à l'interne. L'utilisateur ne peut ni entretenir ni remplacer des composants accessibles uniquement en ouvrant le couvercle de protection avec des outils.

Seul du personnel de service qualifié et dûment formé est autorisé à retirer les couvercles de protection.

The Liebert *e*XM operates in the modes shown in **Table 22**. This section describes various kinds of operating procedures under each operating mode, including transfer between operating modes, UPS setting and procedures for turning on/off inverter.

Table 22 UPS operating modes

Operating Mode		Descriptions
Normal mode	NORMAL	UPS powers the load
Bypass mode	BYPASS	The load power supply is provided by the static bypass. This mode can be regarded as a temporary transition mode between the normal mode and maintenance bypass mode, or a temporary abnormal operating status.
Maintenance Mode	MAINT	UPS shuts down, the load is connects to the mains through the Liebert MBC. In this mode the load is not protected against abnormal input utility power.

As shown in SL-25651, the Liebert *e*XM Battery Cabinet manual, the AC utility source is supplied through the input breaker, and the rectifier converts the alternating current into DC power. The inverter converts the AC power from the utility—or DC power from an optional External Battery Cabinet—into AC power for the load. The batteries power the load through the inverter in the event of a power failure. The utility source can also power the load through the static bypass.

If maintenance or repair of the UPS is necessary, the load can be switched without interruption in service using the optional Liebert MBC.

7.19 Static Bypass Switch

The circuit block labeled "Static Bypass" contains an electronically controlled switching circuit that enables the critical load to be connected to either the inverter output or to a bypass power source via the static bypass line. During normal system operation, the load is connected to the inverter and the inverter contactor is closed; but in the event of a UPS overload or inverter failure, the load is automatically transferred to the static bypass line.

To provide a clean (no-break) load transfer between the inverter output and static bypass line, the static switch activates, connecting the load to bypass. To achieve this, the inverter output and bypass supply must be fully synchronized during normal operating conditions. This is achieved through the inverter control electronics, which make the inverter frequency track that of the static bypass supply, provided that the bypass remains within an acceptable frequency window.

NOTE

When the UPS is operating in static bypass mode or on maintenance bypass, the connected equipment is not protected from power failures or surges and sags.

8.0 SPECIFICATIONS AND TECHNICAL DATA

8.1 Conformity and Standards

The Liebert *e*XM has been designed to conform to the following standards:

Safety	UL 1778, 4th Edition, CSA 22.2 107.3
Surge	IEC 61000-4-5 Criteria B
Harmonics	IEC 61000-3-4
Electrical Fast Transient	IEC 61000-4-4, Criteria B
ESD	IEC 61000-4-2, Criteria B
FCC	Part 15, Class A
Radiated Immunity	IEC 61000-4-3, Criteria A
Conducted Immunity	IEC 61000-4-6, Criteria A
Low-Frequency Signals	IEC 61000-2-2 Criteria A
Transportation	ISTA Procedure 1H
ISO	9001
Misc	OSHA, ASME, NEMA PE-1

The Liebert *e*XM has UL and c-UL approval.

8.1.1 ENERGY STAR® Certification

The Liebert *e*XM UPS is ENERGY STAR certified satisfying "ENERGY STAR Program Requirements Product Specification for Uninterruptible Power Supplies (UPSs) - Eligibility Criteria, Version 1.0."

8.2 UPS Environmental

The Liebert *e*XM is designed to operate under the following environmental conditions without damage or degradation in electrical operating characteristics:

Table 23 Environmental requirements

Item	Requirements
Acoustical Noise, dBA, at 55 in. (1.4m)	60
Operating Altitude	3200ft. (1000m). (1% maximum kW de-rate per 100m rise between 3200 and 9800 ft. [1000-3000 meters)
Relative Humidity	95%
Operating Temperature, °F (°C)	104 (40)
UPS Storage/Transport Temperature, °F (°C)	-4 to 158 (-20 to 70)

Table 24 UPS mechanical characteristics

Rated Power, kVA	120 - 200
Dimensions W x D x H, in (mm)	34-2/3 x 39-3/8 x 78-3/4 (880 x 1000 x 2000)
Weights	See **Table 1** for weights
Color	RAL 7021 (Black)
Protection Degree IEC (60529)	IP20

8.3 UPS Electrical Characteristics

Refer to additional circuit breaker notes in **3.2.6 - Accessory Fuses and Back-Feed Breaker Wiring**.

NOTE

The breakers and cables used must be in accordance with NEC ANSI/NFPA 70. A disconnect breaker must be provided for AC input, DC input and AC output. Recommended cable sizes are suitable for operation at a maximum temperature of 104°F (40°C).

Table 25 UPS currents and terminals—Input, single-input unit, 208V operation

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current, Total	Copper Wire	Aluminum Wire
120	356	409	600	M12	760	(2) 500	(3) 350
140	415	478	600	M12	760	(2) 500	(3) 350
160	475	546	700	M12	930	(3) 350	(3) 500
180	534	614	800	M12	1140	(3) 500	(4) 400
200	594	682	1000	M12	1240	(4) 350	(4) 500

Wire sized for operation at 40°C.

Table 26 UPS currents and terminals—Input, dual-input unit, 208V operation

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current, Total	Copper Wire	Aluminum Wire
120	356	409	600	M12	760	(2) 500	(3) 350
140	415	478	600	M12	760	(2) 500	(3) 350
160	475	546	700	M12	930	(3) 350	(3) 500
180	534	614	800	M12	1140	(3) 500	(4) 400
200	594	682	1000	M12	1240	(4) 350	(4) 500

Wire sized for operation at 40°C.

Table 27 UPS currents and terminals—Bypass, dual-input unit, 208V operation

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current, Total	Copper Wire	Aluminum Wire
120	333	333	450	M12	620	(2) 350	(2) 500
140	389	389	500	M12	620	(2) 350	(2) 500
160	444	444	600	M12	760	(2) 500	(3) 350
180	500	500	700	M12	930	(3) 350	(3) 500
200	555	555	700	M12	930	(3) 350	(3) 500

Wire sized for operation at 40°C.

Table 28 UPS currents and terminals—Output

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current, Total	Copper Wire	Aluminum Wire
120	333	333	450	M12	620	(2) 350	(2) 500
140	389	389	500	M12	620	(2) 350	(2) 500
160	444	444	600	M12	760	(2) 500	(3) 350
180	500	500	700	M12	930	(3) 350	(3) 500
200	555	555	700	M12	930	(3) 350	(3) 500

Wire sized for operation at 40°C.

Table 29 Specifications for customer-supplied external DC source for Liebert eXM UPS

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current, Total	Copper Wire
120	448	560	600	M12	760	(2) 500
140	522	653	680	M12	930	(3) 350
160	597	746	800	M12	1140	(3) 500
180	672	840	900	M12	1240	(4) 350
200	746	933	1000	M12	1240	(4) 350

Wire sized for operation at 40°C.
A Liebert BIB is required for shunt trip of the Customer Supplied Breaker for the External DC Source. Refer to SL-25651, available at Liebert's Web site, **www.liebert.com,** for additional details.

Table 30 Rectifier input

Parameter	120-200kVA	
AC Input Parameters	50/60Hz, 3-Phase, 4-Wire Plus Ground	
Rated AC Voltage	208/120V	220/127V
Input Voltage Range, Startup/Operating	177-253VAC	187-264VAC
Input Voltage Range, Operating *	125-253VAC	132-264VAC
Frequency	50 or 60Hz (40-70Hz Range)	
Power Factor	0.99 Full Load, 0.98 Half Load	
UPS Capacities (kVA)	120/140/160/180/200	
Input Current (A), Rated		
120kVA UPS	356	337
140kVA UPS	416	393
160kVA UPS	475	449
180kVA UPS	534	505
200kVA UPS	594	562
Input Current (A), Max		
120kVA UPS	409	387
140kVA UPS	478	452
160kVA UPS	546	516
180kVA UPS	614	581
200kVA UPS	682	645
THD	5% Full Load	

* Derated operation for reduced input voltage: 208V Operation (125-177VAC), 220V Operation (132-187VAC).

Table 31 Battery DC intermediate circuit

Parameter	120-200 kVA
Battery Bus Voltage	288
Number of Lead-Acid Cells	144 = (24 x 6 cell [12V] blocks), nominal
Float Voltage	2.25V/cell, selectable from 2.2 - 2.3V/cell
Temperature Compensation	-3.0mV/°C, selectable from 0 to -5.0mV/°C around 77°F (25°C) or 86°F (30°C) or inhibit
Ripple Voltage	≤1%
Ripple Current	≤5%
Boost Charge Voltage	2.35 V/cell (selectable from 2.30-2.40V/cell)
Boost Control	Float-boost current trigger 0.050 C10; selectable 0.030-0.070 Boost-float current trigger 0.010 C10; selectable 0.005-0.025 24 hour safety time-out; selectable 8-30 hr Boost charge mode inhibit; selectable
End of Discharge	1.67 V/cell (selectable from 1.60-1.750V/cell)
Battery Charge	2.35 V/cell (selectable from 2.3-2.4V/cell) Constant current and constant voltage charge mode Programmable auto trigger or inhibit of boost mode
Battery Charging Power Maximum Current	UPS, kVA: 120, 140, 160, 180, 200 Battery Charging Power, kW: 18, 21, 24, 27, 30 Maximum Charging Current, A: 54, 63, 72, 81, 90

Table 32 Inverter output to critical load

Parameter	120-200 kVA
Rated AC Voltage	208/120V or 220/127V, 50/60Hz, 3-Phase, 4-Wire Plus Ground
Frequency	50/60
Overload Capacity	110% load, 60 minutes 125% load, 10minutes 150% load, 60 seconds
Fault Current	Short circuit for 200 ms
Non-Linear Load Capability	100%
Neutral Current Capability	170%
Steady State Voltage Stability	±1% (balanced load)
Voltage Regulation	±1% for balanced load ±5% for 100% unbalanced load
Phase Balance	120° ±1° for balanced load 120° ±15°± for 100 unbalanced load
Transient Voltage Response	
THD	<1.5% (0-100% linear load) <4% (0-100% non-linear load)
Sync Frequency Range	Rated frequency ± 2Hz (selectable ± 0.5 to ± 3Hz)
Frequency Slew Rate	0.1-3Hz
Frequency Regulation	Less than ±0.25%
Voltage Adjustment Range	±5%

Table 33 Bypass input

Parameter	120-200 kVA
Rated AC Voltage	208/120V or 220/127V, 50/60Hz, 3-Phase, 4-Wire Plus Ground
Rated Current, A: 208V	333/389/444/500/555
Rated Current, A: 220V	314/367/419/472/524
Overload	150% load, long term
Upstream Protection, Bypass Line	Thermomagnetic Circuit-Breaker, rated up to 125% of nominal output current
Current Rating of Neutral Cable, A	1.7*In
Frequency, Hz	50 or 60
Transfer Time Between Bypass and Inverter, ms	Uninterrupted Transfer: <1ms Interrupted Transfer: <20ms (40,60,80,100, can be selected)
Bypass Voltage Tolerance, %VAC	Upper Limit: +10, +15 or +20, default +15 Lower Limit: -10, -20, -30 or -40; default: -20 (Delay to Accept Steady Bypass Voltage: 10 sec)
Bypass Frequency Tolerance, %	± 10% or ± 20%; default: ± 20%
Synchronization Window	± 0.5, 1,2,3Hz Default Value: ±2Hz

Table 34 AC/AC efficiency, loss and air exchange

AC/AC Efficiency	Data				
Normal Mode (dual conversion), %	95.5% Max				
Inverter Efficiency (DC/AC) (Battery at nominal voltage 288 VDC and full-rated linear load)					
Rated Power, kVA	120-200				
Battery Mode, %	94.8% Max				
Heat Losses and Air Exchange					
Rated Power, kVA	120	140	160	180	200
Normal Mode, kW	6.6	7.7	8.8	9.9	11
No Load, kW	1.8	2.1	2.4	2.7	3
Maximum Forced Air Cooling (Front Intake, Rear Exhaust), CFM (m^3/hr)	407 (691)	475 (806)	542 (922)	610 (1037)	678 (1152)
Heat Dissipation, BTU/Hr (kW)	21,193 (6.21)	23,512 (6.89)	29,529 (8.65)	31,994 (9.37)	35,548 (10.42)

Table 35 Recommended lug sizes (Compression Type) M12, 1/2" bolt

Cable Size	T&B Copper Two-Hole	T&B Aluminum Two-Hole
#6AWG	256-030695-868	—
#4AWG	256-030695-733	—
#2-3AWG	54811BE	—
#1AWG	54857BE	—
#1/0AWG	256-30695-593	—
#2/0AWG	54862BE	60238
#3/0AWG	54864BE	60244
#4/0AWG	54866BE	60250
250kcmil	54868BE	60256
300kcmil	54870BE	60262
350kcmil	54872BE	60267
400kcmil	54874BE	60269
500kcmil	54876BE	60273
600kcmil	54878BE	60275
700kcmil	54879BE	60277
750kcmil	54880BE	60278

9.0 MAINTENANCE

9.1 Safety Precautions

Observe the safety precautions in **Important Safety Instructions on page 1**.

Only properly trained and qualified personnel should perform maintenance on the UPS system.

Observe all of the warnings and cautions below before performing any maintenance on the UPS system and associated equipment. Also observe the manufacturer's safety precautions pertaining to the battery, along with the battery safety precautions in this document.

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Only Emerson or Emerson-trained service personnel should work on this equipment. Both AC and DC high voltages are present in lethal amounts within this equipment. Extreme care should be taken when working around UPS equipment.

Always identify the source of connecting wiring prior to disconnecting. Mark any disconnected wires, so they can be properly reconnected.

Do not substitute parts except as authorized by Emerson.

Maintain the UPS cabinets free of foreign materials such as solder, wire cuttings, etc.

Call Liebert Services if you are not sure of the procedures to follow or if you are not familiar with the design or operation of the equipment.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

L'entretien et la réparation de cet équipement doivent être confiés exclusivement à un personnel qualifié d'Emerson ou formé par Emerson. Des hautes tensions c.a. et c.c. mortelles sont présentes dans cet équipement. Faites preuve d'une grande prudence lorsque vous travaillez à proximité d'un système ASC.

Identifiez toujours la source d'un câble de raccordement avant de le débrancher. Identifiez les câbles déconnectés afin de pouvoir les reconnecter correctement.

Ne remplacez aucun composant sans l'autorisation expresse d'Emerson.

Assurez-vous que les armoires d'ASC sont exemptes de matériaux étrangers tels que des résidus de soudure, des bouts de câble, etc.

Communiquez avec Liebert Services si vous doutez de la procédure à suivre ou si la conception ou le fonctionnement de l'équipement ne vous sont pas familiers.

WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Extreme caution is required when performing maintenance.

Be constantly aware that the UPS system contains high DC as well as AC voltages. With input power Off and the optional battery cabinet disconnected, high voltage at filter capacitors and power circuits should be discharged within 30 seconds. However, if a power circuit failure has occurred, you should assume that high voltage still exists after shutdown. Check with a voltmeter before making contact.

AC voltage will remain on the bypass and output contactors and the static bypass switch, unless the associated external circuit breakers are opened.

Check for voltage with both AC and DC voltmeters before making contact.

When the UPS system is under power, both the operator and any test equipment must be isolated from direct contact with earth ground and the UPS chassis frame by using rubber mats.

Some components within the cabinets are not connected to chassis ground.

Any contact between floating circuits and the chassis is a lethal shock hazard. Use differential oscilloscopes when measuring a floating circuit. The differential input should have at least 800_{vrms} common mode input rating and a common mode rejection ratio of at least 80 dB.

Exercise caution that the test instrument exterior does not make contact either physically or electrically with earth ground.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers, or others approved for use in electrical fire fighting.

AVERTISSEMENT

Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort.

Les opérations d'entretien requièrent une extrême prudence.

Soyez toujours conscient du fait que le système ASC contient des tensions c.c. et c.a. élevées. Une fois l'alimentation d'entrée et du boîtier facultatif de batteries coupées, la haute tension aux condensateurs de filtrage et aux circuits d'alimentation devrait se dissiper en moins de 30 secondes. En cas de défaillance d'un circuit d'alimentation, toutefois, il importe de présumer qu'une tension élevée est présente même après l'arrêt. Vérifiez toujours les tensions avec un voltmètre avant d'établir des contacts.

Les contacteurs de dérivation et de sortie, de même que le commutateur statique de dérivation, continueront d'afficher une tension c.a. à moins que les disjoncteurs externes associés ne soient ouverts.

Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact.

Lorsque le système ASC est sous tension, les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc pour prévenir tout contact direct avec le sol et avec le châssis du système lors des interventions.

Certains composants à l'intérieur des armoires ne sont pas connectés à la masse du châssis.

Tout contact entre les circuits flottants et le châssis présente un risque de décharge mortelle. Utilisez des oscilloscopes différentiels lors des mesures d'un circuit flottant. L'entrée différentielle devrait être d'au moins 800 Vrms en mode commun et avoir un taux de réjection de mode commun d'au moins 80 dB.

Il importe de veiller à ce que l'extérieur des équipements d'essai n'entre pas en contact physique ou électrique avec le sol.

En cas d'incendie associé à du matériel électrique, n'utilisez que des extincteurs à dioxyde de carbone ou homologués pour la lutte contre les incendies d'origine électrique.

9.2 Limited-Life Components

The Liebert *e*XM UPS has a design life well in excess of 10 years. Well-maintained units can continue to provide economic benefits for 20 years or more. Long-life components are used in the UPS wherever practical and cost-effective. However, due to the currently available component material, manufacturing technology limitations and the general function and use of the component, a few components in your Liebert UPS will have a shorter life cycle and require replacement in less than 10 years.

The following components utilized in your UPS system have a limited life cycle and are specifically exempt from warranty. To prevent a wear-out failure of one of these components affecting your critical load operations, Liebert recommends these components be periodically inspected and replaced before the expected expiration of their life cycle. The expected life of each component listed below is simply an estimate and is not a guarantee. Individual users may have site-specific requirements, maintenance and other environmental conditions that affect the length of the component's useful life cycle.

Table 36 Component service life

Component	Expected Life	Replace in:
Air filters	5 years	Check four times per year

In most cases, replacement components must exactly match the original component specifications. These replacement components are not readily available from third-party component distributors. For assistance with your specific component specifications, replacement component selection and sourcing, call 1-800-LIEBERT. For customers using Emerson Network Power Liebert Services' preventive maintenance services, periodic inspection of these components is part of this service, as well as recommending component replacement intervals to customers to avoid unanticipated interruptions in critical load operations.

9.3 Routine Maintenance

Become thoroughly familiar with the equipment, but at no time go beyond the specific procedures in this manual while performing maintenance or correcting a malfunction. If you have any doubt as to what must be done, call Emerson® Network Power Liebert Services at 1-800-LIEBERT for further instructions. The UPS is designed for unattended operation, but does require some common sense maintenance.

- Keep good records—Troubleshooting is easier if you maintain historical service records.
- Keep the UPS free of dust and any moisture.
- Keep the UPS cool:
  - Battery systems must be kept in the range of 72-77°F (22-25°C) in order to meet design specifications for capacity and longevity.
  - The UPS will reliably meet all performance specifications at temperatures up to 104°F (40°C), and can be slightly derated for operation at even higher temperatures. However, performance and longevity will be optimized when the UPS is operated at the same temperature as the batteries.
- Keep connections tight.
- Tighten all connections at installation and at least annually thereafter. (See **9.3.3 - Torque Requirements**).

9.3.1 Record Log

Set up a maintenance log to record scheduled checks and any abnormal conditions.
The log should have space for all metered data including phase readings, alarm messages, UPS mode of operation, air filter replacement date and observation notes. A second log should be maintained for the battery module as directed by the battery manufacturer.
Emerson recommends a periodic walk-through inspection of the UPS and battery rooms to check for visible and audible indications of problems. Log the inspection, metered parameter indications and any discrepancies.

9.3.2 Air Filters

The air filters must be inspected and serviced on a regular schedule. The period between inspections will depend upon environmental conditions. Under normal conditions, the air filters will require cleaning or replacement approximately every two months.

All Liebert *e*XM models have replaceable filter elements behind the grille in the front of the unit. This element can be changed with the UPS operating by opening the outer door. The Liebert *e*XM's air filters are washable and reusable. Two sets of air filters are shipped with each Liebert *e*XM.

Abnormal or dusty conditions will require more frequent cleaning and replacement of air filters. Inspect installations in new buildings more often, then extend the inspection period as experience dictates.

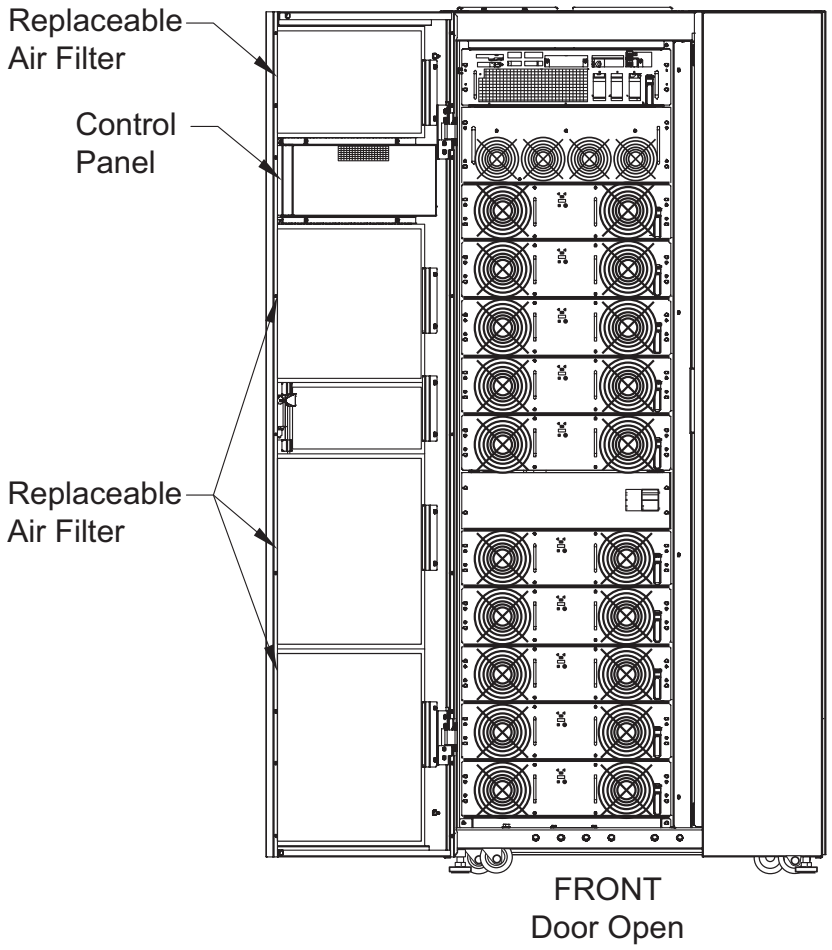
Replacing Air Filters

Installing the two air filter sizes in a Liebert *e*XM requires only a Phillips screwdriver. Each filter is held in place by a bracket on either side of each filter. Two sets of washable and reusable dust filters are shipped with each UPS. Refer to **9.3.2 - Air Filters** for details about filter maintenance.

To replace a filter:

1. Open the UPS front door and locate the filters on the back side of the front door (see **Figure 42**).
2. Remove one bracket and loosen the screw on the second bracket. The second bracket need not be removed.
3. Remove the dust filter to be replaced.
4. Insert the clean filter.
5. Reinstall the bracket, tightening the screw securely.
6. Tighten the screw on the second bracket.

Figure 42 Air filter replacement



9.3.3 Torque Requirements

All electrical connections must be tight.

Tables 37 through **38** provide the torque values for the connections in the UPS and batteries. Use these values unless the equipment is labeled otherwise.

Table 37 Busbars (for power wiring)

Bolt Shaft Size	Lb-in (Nm)
1/2" (M12)	428 (48)

Table 38 Terminal block with compression lugs (for control wiring)

AWG Wire Size or Range	Lb-in (Nm)
#22 - #14	3.5 to 5.3 (0.4 to 0.6)

9.4 Detecting Trouble

It is important that the operator check the instrument readings if abnormal equipment performance is suspected. Any metered value that differs appreciably from normal could mean an impending malfunction, and should be investigated.

Items to check on the various UPS display screens include:

1. Output voltage of all phases should be within 2% of normal voltage. Output currents on each phase should not normally differ by more than 20%. If a greater difference is noted, the load is unbalanced and corrective action should be taken to redistribute the load, if possible.
2. If the UPS has not operated on battery power during the last 10 hours, the batteries should require little charging current. Battery mimic should indicate normal DC voltage with relatively little battery charge current.
3. Input current on each phase should be within 10% of the average input current. Alarm messages indicate malfunction or impending malfunction. A daily check of the Operator Control Panel will help to provide an early detection of problems. Refer to **Appendix B - - UPS Status Messages** to interpret alarm messages.
4. Tracing a problem to a particular section is facilitated by alarm messages and the metered parameter indications. These are stored in the Status Reports and can be displayed at the Operator Control Panel or at an optional terminal.

NOTE
If the UPS system has a blown fuse, the cause should be determined before you replace the fuse. Contact Liebert Global Services.

9.5 Reporting a Problem

If a problem occurs within the UPS, review all alarm messages along with other pertinent data. This information should be given to the Liebert Service dispatcher. Call 1-800-LIEBERT to report a problem or to request assistance.

9.6 Corrective Actions

Recommended corrective actions for each alarm message on the Operator Control Panel and the Remote Alarm Status Panel may be found in **Appendix B - - UPS Status Messages**.

9.7 Recommended Test Equipment

Table 39 lists recommended test equipment and tools required to maintain, troubleshoot and repair the UPS module. Instruments of equivalent range and accuracy may be substituted. All instruments should be calibrated and be within the current calibration cycle. Calibration data for the instruments should be maintained in equipment-history files and the instruments labeled for audit and verification.

Table 39 Recommended test equipment and tools

Qty	Test Equipment	Manufacturer	Model or Type
1	Oscilloscope	Tektronix, H-P or Fluke	DC to 50 MHz
2	Voltage Probes	Tektronix, H-P or Fluke	10X, with 10 ft. Cable
2	Voltage Probes	Tektronix, H-P or Fluke	100X, with 10 ft. Cable
1	Digital Multi-meter	Fluke	8060, with Test Leads
1	Tool Kit	N/A	Standard electrical contractor tools

APPENDIX A - HAZARDOUS SUBSTANCES OR ELEMENTS ANNOUNCEMENT

Table 40 Hazardous substances or elements

Part Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chrome (Cr^{6+})	Polybrominated Biphenyl (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Hex copper stud	X	✔	✔	✔	✔	✔
PCBA	X	✔	✔	✔	✔	✔
AC capacitor	X	✔	✔	✔	✔	✔
DC capacitor	X	✔	✔	✔	✔	✔
Fan	X	✔	✔	✔	✔	✔
Cables	X	✔	✔	✔	✔	✔
LCD	X	X	✔	✔	✔	✔
Sensors	X	✔	✔	✔	✔	✔
Large-medium power magnetic components	X	✔	✔	✔	✔	✔
Circuit breaker / rotating switch	X	✔	✔	✔	✔	✔
Semiconductors	X	✔	✔	✔	✔	✔
Battery (when applicable)	X	✔	✔	✔	✔	✔
Insulation monitoring device (when applicable)	X	✔	✔	✔	✔	X

✔ - Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

X - Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Emerson Network Power Co., Ltd. has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. All solders in the products contain lead.
2. Copper alloy contains lead.
3. Backlight bulb contains mercury.
4. The ceramic materials of the ceramic capacitor, the copper terminals and copper leads of metallic film capacity contain lead.
5. The glass of resistor contains lead.
6. The glass of LCD contains lead, and the backlight lamp contains mercury.
7. The lead in the battery is determined by the battery feature and technical levels.
8. The insulation monitoring device contains lead and PBDE.

About Environment Protection Period: The Environment Protection Period of the product is marked on the product. Under normal working conditions and normal use of the products observing relevant safety precautions, the hazardous substances in the product will not seriously affect the environment, human safety or property in the Environment Protection Period starting from the manufacturing date.

About battery: The battery life is dependent on the ambient temperature and charging / discharging times. The battery life will be shortened if the battery is used under high temperature or in deep discharging status. Refer to the manufacturer's product literature for details.

APPENDIX B - UPS STATUS MESSAGES

Table 41 shows all event messages as they appear in the current status area of the LCD or the history log, along with a description and recommended actions, if any. For further information on the current status area and the history log, see **6.10 - UPS History Log**.

Table 41 UPS status messages

Event Message	Description / Suggested Action (if any)
Comm. Fail	The CAN communication between internal monitor and rectifier/inverter/bypass fails. Contact Liebert Services at 800-543-2378 for assistance.
Battery Overtemp	The battery temperature is over the limit. Check the battery temperature and ventilation.
Ambient Overtemp	The Ambient temperature is over limit. Check the ventilation of UPS room.
Replace Battery	Battery should be replaced. Contact Liebert Services at 800-543-2378 for assistance.
Battery Low Pre-warning	Before the end of discharging, battery under-voltage pre-warning should occur. After this pre-warning, battery should have the capacity for 3 minutes discharging with full load. The time is user configured from 3 to 60 minutes. Shut down the load in time.
Battery End of Discharge	Inverter turned off due to low battery voltage. Check the utility failure and try to fix it.
Mains Volt. Abnormal	Mains Voltage exceeds the upper or lower limit and results in rectifier shutdown. Check the input line-to-neutral voltage amplitude of rectifier.
Mains Undervoltage	Mains Voltage is undervoltage (120v~132V). Check the input line-to-line voltage amplitude of rectifier.
Mains Freq. Abnormal	Mains frequency is out of limit range and results in rectifier shutdown. Check the rectifier's input voltage frequency.
Rectifier Fault	Rectifier Fault; Contact Liebert Services at 800-543-2378 for assistance.
Rectifier Overtemp	The temperature of heat sink is too high to keep the rectifier running. The UPS can recover automatically. Check the environment and ventilation.
Charger Fault	The Charger has failed. Contact Liebert Services at 800-543-2378 for assistance.
Input Fuse Fail	Input fuse is open. Contact Liebert Services at 800-543-2378 for assistance.
Control Power 1 Fail	Control Power 1 has failed or has been lost. Contact Liebert Services at 800-543-2378 for assistance.
Mains Phase Reversed	Input phase sequence is reversed. Contact Liebert Services at 800-543-2378 for assistance.
Soft Start Fail	Rectifier could not start due to low DC bus voltage. Contact Liebert Services at 800-543-2378 for assistance.
Bypass Unable to Trace	This alarm is triggered by an inverter software routine when the amplitude or frequency of bypass voltage is beyond the normal range. The amplitude threshold is fixed for positive and negative 10% rating. This alarm automatically resets once the bypass voltage goes normal. 1. First verify that the bypass voltage and frequency displayed on the panel is within the selected range. Note here the rated voltage and frequency are specified by "Output voltage level" and "Output frequency level" respectively. 2. If the displayed voltage is believed to be abnormal, then verify the bypass voltage and frequency presented to the UPS. Check the external supply if it is found to be faulty. Contact Liebert Services at 800-543-2378 for assistance.
Bypass Abnormal	This alarm is triggered by an inverter software routine when the amplitude or frequency of bypass voltage exceeds the limit. This alarm automatically resets once the bypass voltage goes normal. First check if there are some relevant alarms such as "Bypass disconnect open", "Bypass phase reverse" and "Mains neutral lost". If they appear, solve them first. 1. Then verify that the bypass voltage and frequency displayed on the panel is within the bypass limit. Note here the rated voltage and frequency are specified by "Output voltage level" and "Output frequency level" respectively. 2. If the displayed voltage is believed to be abnormal, then verify the bypass voltage and frequency presented to the UPS. Check the external bypass supply if it is found to be faulty. If the utility is likely to trigger this alarm frequently, the bypass limit can be changed a little larger through the configuration software according to the customer's agreement. Contact Liebert Services at 800-543-2378 for assistance.

Table 41 UPS status messages *(continued)*

Event Message	Description / Suggested Action (if any)
Inverter Asynchronous	This alarm is triggered by an inverter software routine when the inverter and bypass waveforms are misaligned by more than 6 degrees in phase. This alarm resets automatically once the condition is no longer true. 1. First check if the alarm “Bypass unable to trace” or “Bypass abnormal” occurs. If so, solve it first. 2. Verify the waveform of the bypass voltage. If it is too distorted, ask the customer to verify and seek any possible measurements. Contact Liebert Services at 800-543-2378 for assistance.
Inverter Fault	This alarm indicates a fault condition exists within the inverter. Contact Liebert Services at 800-543-2378 for assistance.
Fan Fault	At least one of the cooling fans failed. Contact Liebert Services at 800-543-2378 for assistance.
Inverter STS (relay) Fail	At least one of the static switches of inverter side is open or short circuit. This fault is locked until power off. Contact Liebert Services for assistance at 800-543-2378 for assistance.
Bypass STS Fail	At least one of the static switches of bypass side is open or short circuit. This fault is locked until power off. Contact Liebert Services at 800-543-2378 for assistance.
Output Fuse Fail	At least one of the output fuses is open. Contact Liebert Services at 800-543-2378 for assistance.
Control Power 2 Fail	Control Power 2 is abnormal or lost. Contact Liebert Services at 800-543-2378 for assistance.
Unit Overload	The UPS is confirmed to be overload when the load arises above 105% nominal rating. The alarm automatically resets once the overload condition is removed. 1. Confirm that the alarm is true by checking the load percent indicated on the LCD panel to determine which phase is being overloaded. 2. If the alarm is true, measure the actual output current to verify that the indications are valid. Disconnect unnecessary load and ensure the safety. In a parallel system, a severe load sharing error can also leads to the alarm. Contact Liebert Services at 800-543-2378 for assistance.
System Overload	The UPS parallel system is confirmed to overload when the total load arises above 105% nominal rating for the set basic number of UPSs. The alarm automatically resets once the overload condition is removed. 1. Confirm that the alarm is true by checking the system load percent indicated on the LCD panel to determine which phase is being overloaded. 2. If the alarm is true, measure the actual output current to verify that the indications are valid. Disconnect unnecessary load and ensure the safety. In a parallel system, a severe load sharing error can also leads to the alarm.
Unit Overload Timeout	The UPS is confirmed to overload and the overload times out. **Note 1:** The highest loaded phase will indicate overload timing-out first. **Note 2:** When the timer is active, then alarm “unit overload” should also be active as the load is above nominal. **Note 3:** When the timer has expired, the inverter Static Switch is opened and the load transferred to bypass. The inverter shutdown and will restart after 10 seconds. **Note 4:** If the load decreases lower than 95% after 5 minutes, the system will transfer back to inverter mode. Confirm that the alarm is genuine by checking the load percent indicated on the LCD. If an overload is indicated then check the load, and investigate any additional load connected prior to the alarm (if applicable).
Bypass Phase Reversed	The phase sequence direction of bypass voltage is reversed. Normally, the phase of Phase B lags 120 degrees behind Phase A, and the phase of Phase C lags 120 degrees behind Phase B. Verify that the phase rotation of the bypass supply presented to the UPS is correct, and rectify it if it is found to be in error. Contact Liebert Services at 800-543-2378 for assistance.
Load Impact Transfer	A transfer to bypass occurred due to a large step load. The UPS should recover automatically. Turn on connected equipment in sequential order to reduce the step loading of the inverter.
Transfer Timeout	The load is on bypass power due to excessive number of transfers that occurred within the last hour. The UPS will recover automatically and will transfer the load back to inverter power within an hour.
Load Sharing Fault	UPS working within a parallel system are not sharing load current correctly. Contact Liebert Services at 800-543-2378 for assistance.

Table 41 UPS status messages *(continued)*

Event Message	Description / Suggested Action (if any)
DC Bus Abnormal	Shut off inverter due to abnormal DC bus voltage. Contact Liebert Services at 800-543-2378 for assistance.
System Transfer	The whole paralleled UPS system transferred to bypass at the same time. This message will appear on the UPS which passive transfer to bypass.
DC Bus Overvoltage	Rectifier, inverter and battery converter were shutdown because DC bus voltage is too high. Check whether there is a fault in rectifier side. If no, then check whether overload occurs. Restart the inverter after resetting the fault. If fault does not clear, contact Liebert Services at 800-543-2378 for assistance.
LBS Active	The LBS setting is active. The UPS is acting as an LBS master or slave in a dual bus configuration.
Battery ground fault	Battery ground fault from dry contact signal. Contact Liebert Services at 800-543-2378 for assistance.
Inverter turned On manually	Manual Turn On via front panel
Inverter turned Off manually	Manual Turn Off via front panel
EPO	Emergency Power Off
Transfer Confirm	Interrupted Transfer Confirm
Transfer Cancel	Interrupted Transfer is cancel
Unit Off Confirm	Unit Turned Off Confirm
System Off Confirm	System Turned Off Confirm
Fault Reset	Fault Reset
Alarm Silence	Alarm Silence
Turn On Fail	Turn On Fail
Alarm Reset	Audible Alarm Reset
Bypass Mode	UPS in Bypass Mode
Normal Mode	UPS in Normal Mode
Battery Mode	UPS in Battery Mode
Output Disabled	UPS Output Disabled
Maint. Disconnect Closed	Maintenance Disconnect Closed
Reserved	—
Output Disconnect Open	Output Disconnect Open
Battery Reverse	Connect the battery again and check the wiring of batteries.
No Battery	Check the battery and the wiring of batteries.
Auto start	After UPS was shutdown at EOD, inverter auto starts when utility is restored.
BCB closed	BCB closed from dry contact signal.
BCB open	BCB open from dry contact signal.
Battery Float Charging	Battery is float charging.
Battery Boost Charging	Battery is boost charging.
Battery Discharging	Battery is discharging.
Battery Period Testing	Battery is period self-testing.
Batt. Capacity Testing	Battery is capacity self-testing.
Batt. Maint. Testing	Battery is maintenance self-testing.
Inverter in Setting	Inverter is in parameter setting.
Rectifier in Setting	Rectifier is in parameter setting.
Batt. Converter Fault	Battery converter output voltage beyond limits or battery fuse failed. Battery converter shuts down. Battery backup not available.
Operation Invalid	This record is registered following an incorrect operation.

Table 41 UPS status messages *(continued)*

Event Message	Description / Suggested Action (if any)
Byp. Abnormal Shutdown	Both bypass and inverter voltages unavailable. Load interruption.
Mains Neutral Lost	AC Input mains reference neutral not detected.
Battery Room Alarm	Environment in battery room needs attention.
Rec Flash Update	Rectifier firmware is being updated.
Inv Flash Update	Inverter firmware is being updated.
Monitor Flash Update	Monitor firmware is being updated.
LBS abnormal	LBS is abnormal.

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